ON

THE THEORY AND ART

OF

PRESCRIBING.

" To know
" That which before us lies in daily life,
" Is the prime wisdom."

MILTON.

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ON

THE THEORY AND ART

OF

PRESCRIBING.

OF MEDICINAL COMBINATION.

"Variorum mixtura novas sæpe vires generet, in simplicibus nequaquam reperiundas longe saluberrimas."—*Gaubius.*

It is a truth universally admitted, that the arm of physic has derived much additional power and increased energy, from the resources which are furnished by the mixture and combination of medicinal bodies. I by no means intend to insinuate that the physician cannot frequently fulfil his most important indications by the administration of one simple remedy; I only contend that, in many cases, by its scientific combination with other medicines, it will not only act with greater certainty and less inconvenience, but that its sphere of influence may be thus more widely extended, and its powers so modified or changed, as to give rise to a remedy of new powers. Such a theory is amply justified by the state of combination in which certain medicinal principles are found in our more efficient vegetable remedies, while the medicinal practice founded upon it is thus, as it were, sanctioned by Nature's own prescriptions; enter but her laboratory, and you will soon be satisfied, that many of her potent remedies do not owe their valuable powers to any one specific ingredient, but to the combined or modified energies of various, and sometimes opposite principles. This view of the subject opens an interesting and unexplored field* of medical and chymical research, and I shall endeavour to avail myself of the novelties its investigation may present,

* I selected it as the exclusive subject of my Lectures before the Royal College of Physicians, during the year 1820.

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and of the hints it may suggest for the improvement of *extemporaneous combination*. By contemplating the laws by which Nature effects her wise purposes, we may learn to emulate her processes, and even in some cases to correct and assist her operations:* such at least has been the happy result of our labours in the other departments of natural knowledge. It is said for instance that by observing the means used by nature for preventing the diffusion of light in the eyeball, Euler derived an important hint for the improvement of his telescope; and more lately, the structure of the crystalline humour of the eye has been successfully imitated in the invention of achromatic lenses. On the other hand, it is hardly necessary to observe to what extent these instruments of art are capable of improving and multiplying the powers of that natural organ, to the contemplation of whose structure and functions, we are, as I have just stated, so greatly indebted for their origin and perfection. So shall I endeavour to show, in the progress of this work, that the combinations of nature, as exemplified in her more valuable remedies, are capable if properly studied, of suggesting many important hints for improving the arrangements of art; while art in return may frequently supply the defects, or extend the advantages of natural compounds.

AN ANALYSIS

OF

THE OBJECTS TO BE ATTAINED BY MIXING AND COMBINING MEDICINAL SUBSTANCES.

The objects to be attained, and the resources which are furnished, by Medicinal Combination, together with the different modes of its operation, and the laws by which it is governed, may with much practical advantage be arranged in the following order.

I.

TO PROMOTE THE ACTION OF THE BASIS, OR PRINCIPAL MEDICINE.

A.—*By combining together several different forms, or preparations, of the same substance.*

The utility of such a combination is obvious, whenever we desire the full and general effects of *all* the principles of a medicinal body in solu-

† It was wisely said by Lord Bacon, "that Man should observe all the workmanship, and the particular workings of Nature, and meditate which of those may be transferred to the Arts." Advancement of Learning, Book v 148. For a further illustration of these views, the partiality of an author may perhaps be excused if he refer the reader to his paper "On the Recent Sandstone," published in the first volume of the Transactions of the Royal Geological Society of Cornwall.

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tion; thus, where the *bark* is required in the cure of an intermittent fever, and the stomach will not allow the exhibition of the powder, it will be eligible to conjoin in one formula, the tincture, decoction, and extract, as exemplified by *Formulæ* 42, 126, 127. The necessity of such a combination may be expressed by the following canon. *Whenever the chymical nature of the medicinal substance will not admit of the full solution of all its active principles in any One Solvent, and its exhibition in substance is at the same time impracticable.* For farther illustrations see *Form.* 2, 25, 33, 38, 70, 109.

Practitioners, probably without having reasoned upon the theory, have very generally adopted the practice, of combining the different solutions of the same substance; for in the prescriptions of practical physicians we commonly find, that the decoction or infusion of a vegetable remedy is quickened by a certain portion of a corresponding tincture.

B.—*By combining the Basis with substances which are of the* SAME NATURE, *that is, which are* INDIVIDUALLY *capable of producing the same effect, but with less energy than when in combination with each other.*

Dr. FORDYCE first established the existence of the singular and important law, that *a combination of similar* remedies will produce a more certain, speedy and considerable effect than an equivalent dose of any single one;* a fact which does not appear to have been known to any ancient physician. The earliest mention of it that I can find is by VALISNIERI, the favourite pupil of Malpighi, who filled the medical chair at Padua in 1711, nearly ninety years before Fordyce published his valuable memoir on the combination of medicines, but he does not attempt any generalization† of the subject; he merely states, as the result of careful experiments, that twelve drachms of *Cassia Pulp* are about equivalent in purgative strength to four ounces of *Manna;* and yet, says he, if we give eight drachms of *Cassia Pulp*, in combination with four drachms of *Manna*, we obtain double the effect! How, adds the professor, can this possibly happen? Surely the very contrary *ought* to obtain, since four drachms of *Cassia* are much more than equivalent to an equal weight of *Manna;* the strength of the former being to that of the latter as 8 to 3.

* The practitioner must receive the term *similar*, conventionally, as expressed at page 73. Many of those substances which we are at present bound to consider *similar*, will no doubt, require to be transplanted into other classes as the progress of physiological knowledge shall elucidate their modes of action. In this attempt to teach the Art of Medicinal Combination, I have endeavoured to reduce the propositions it comprehends to the greatest degree of generality of which they are, at present, susceptible.

† Numerous isolated statements of the same tendency may be adduced, but these cannot invalidate the claim of Dr. Fordyce, as the first person who generalized the fact, and applied it with success to practice. DIEMERBROECK, in his notes upon the Theriaca Andromachi, observes that the composition is a more efficacious medicine from the concurrent powers of so many ingredients, alike in virtue: and Quincy in his Lectures on Pharmacy, which were published by Dr. Shaw, in 1723, says, "those fetid gums which are generally prescribed in Hysteria, as Ammoniacum, Galbanum, &c., may be conjoined with advantage, because from a concurrence of properties, they all conspire to the same end."

The truth of this law of medicinal combination must be continually felt by the practitioner in the ordinary routine of his practice, viz.

Narcotics will better fulfil the intention of allaying irritation and pain, when composed of several of such medicines in combination, than when they consist of any single one, even should the dose, in this latter case, be increased. See *Formulæ* 3, 4, 5.

Antispasmodics acquire increased efficacy by the application of the same principle. *Form.* 20, 21, 22, 23, 24, 25.

Bitter Tonics are also thus exalted, see *Form.* 39, 40, 41. The beneficial effects, however, which arise from combinations of this kind will admit of a satisfactory explanation upon another principle; we may, for instance, consider them as medicines, differing from each other in their composition, and producing by their union an assemblage of bitter, astringent, and aromatic principles.

Aromatic and Diffusible Stimulants. There are perhaps no remedies which receive greater mutual benefit by intermixture with each other, than the individuals which compose this class; for they not only thus acquire increased force and efficacy, but at the same time they lose much of their acrimony; if, for instance, any one spice, as the dried capsule of the *Capsicum*, be taken into the stomach, it will excite a sense of heat and pain; in like manner will a quantity of *Black Pepper;* but if an equivalent quantity of these two stimulants be given in combination with each other, no such sense of pain is produced, but, on the contrary, a pleasant warmth is experienced, and a genial glow felt over the whole body; and if a greater number of spices be joined together, the chance of pain and inflammation being produced is still farther diminished. The truth of this law is also strikingly illustrated, as Dr. Fordyce has observed, by that universal maxim in cookery, *never to employ one spice, if more can be procured;* the object in this case, being to make the stomach bear a large quantity of food without nausea.* This same principle also finds an illustration of its importance, as it regards the class of stimulants, in the following preparations of our Pharmacopœia, viz. "*Pulvis Cinnamomi compositus; Infusum Armoraciæ compositum; Infusum Aurantii compositum; Spiritus Lavendulæ compositus; Tinctura Cinchonæ composita; Tinctura Valeriana Ammoniata;* and the *Confectio Opii*, the elegant and scientific substitute for the celebrated *Mithridate* or *Theriaca.* The practitioner is also referred to *Form.* 45, 47, and to *Allii Radix.*

The local action of these stimulants would appear to be placed under the dominion of the same law, and perhaps the origin of the custom, so long observed, of mixing together the varieties of snuff, may thus receive a plausible and philosophical explanation; certain it is that by such combination the harsh pungency of each ingredient will be diminished, whilst the general potency of the application, in exciting the nerves, will be increased, and rendered more grateful; the same principle will direct the

* Such was the nature of the "Mustacea" of the Romans, which were a species of cake, used at weddings, and consisted of meal, aniseed, cummin, and several other aromatics; their object was to remove or prevent the indigestion which might be occasioned by eating too copiously at the marriage entertainment. It must be acknowledged that this compound was better adapted for such a purpose than the modern bride-cake, to which it gave origin. Cato (de R. R. c. 121) has given us a receipt for the Roman bride-cake.

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formation of safe and efficient plasters and lotions; the *Emplastrum Cumini* of the London, and the *Emplastrum Aromaticum* of the Dublin Pharmacopœia, offer examples of its judicious application.

Astringents. For illustration see *Form.* 51, 58.

Emetics are certainly more efficient when composed of *Ipecacuan* united with *Tartarized Antimony*, or *Sulphate of Zinc*, than when they simply consist of any one of such substances in an equivalent dose. See *Form.* 63, 65.

Cathartics not only acquire a very great increase of power by combination with each other, but they are at the same time rendered less irritating in their operation; the *Extractum Colocynthidis compositum* affords an excellent example of a compound purgative mass being much more active and manageable, and less liable to irritate, than any one of its components separately taken. Additional examples of this fact are furnished by *Formulæ* 70, 76, 78, 79, 81, 88. In many cases, however, the fact of purgatives thus accelerating and correcting each other's operation may be explained by considering them as substances endowed with different powers, as already demonstrated, (p. 91,) and which will be more fully considered in the third division of this Essay.

Diuretics. Under this class of medicinal agents it may be observed that, *whenever a medicine is liable to produce effects different from those we desire, its combination with similar remedies is particularly eligible*, by which the action of the basis may be directed and fixed; thus the individuals which compose the class of Diuretics are uncertain in their operation, and disposed when exhibited singly to produce diaphoretic, and other contrary effects; it is, therefore, in such cases, highly judicious to unite several of them in one Formula, by which we increase their powers, and are more likely to ensure their operation. *Formulæ* 101, 103, 108, 109, 110, 111, 115, are constructed upon this principle.

Diaphoretics. Our maxim, "Vis Unita Fortior," certainly applies with equal truth to this class of medicinal agents. *Form.* 122, 124.

Expectorants. More is frequently to be gained by the co-operation of these remedies than can be obtained by the exhibition of them separately, as in *Form.* 134, 135.

Demulcents do not appear to obtain any other benefit from combination than, occasionally, a convenience and efficacy of application arising from a suitable degree of consistence and solubility. See article "*Trochisci.*"

The operation of the law which has thus formed the first object of this inquiry, will be found, like every other, to have a natural and well defined limit; it is easy to perceive that by multiplying the number of ingredients too far, we shall either so increase the quantity and bulk of the medicine as to render it nauseous and cumbersome, or so reduce the dose of each constituent as to fritter away the force and energy of the combination.

The propriety of combining *several* stimulants, of the diffusible class, in *one* formula, has been questioned on different grounds. Dr. Chapman, in his work on Therapeutics, adduces some arguments on this point, which, although they fail in establishing his general position, certainly suggest an important exception to the practice in question; "by directing," says he, "stimulating remedies, *separately*, we shall economise our resources in many lingering diseases." The justness of this

statement must be admitted to its fullest extent, and practitioners will, on certain occasions, do well to act in conformity with the views that suggested it; for instance, in the feeble forms of protracted fevers, where the indications are to be met with the continued action of stimulants, it will certainly be salutary to alternate the use of *camphor*, *ammonia*, and other remedies of a similar nature, in preference to presenting them all at once in combination, so that the system may not lose its susceptibility by the continued impression of the same stimulant; the same motive should induce us, on particular occasions, to employ in succession different narcotics, for each of them affects sensibility in its own peculiar manner.* The nervous system, as *Richerand* has very justly observed, may be compared to a soil, rich in different juices, and which requires the cultivator to plant the germes of a diversified vegetation to develope the whole of its fecundity; to insure a perpetual return, therefore, it will be right to sow a succession of different seeds. Hoffman also has offered us some advice upon this subject; he directs us in the treatment of chronic diseases to suspend the administration of remedies, at intervals, and afterwards to resume them, lest the system should become *habituated*, and ultimately *insensible* to their influence.

But there remains for investigation a still more important precaution respecting this law of medical combination;—that, in combining substances in the manner, and for the object just related, the practitioner should be well satisfied that their medicinal virtues are in reality *practically* SIMILAR, or he will fall into an error of the most fatal tendency; it has been already shown, and I hope I shall not be considered tedious by again directing the reader's attention to the fact, that medicines are not necessarily similar because they have been arranged in the same artificial division of remedies; in order to establish a perfect similarity *their operations must be found by experience to continue similar under every condition of the human body; and that, moreover, they must owe such similarity to modes of operation which are compatible with each other, and consonant with the general mode of cure;* we have only to refer to the history of Diuretics (*page* 95) for a full illustration of this important truth; thus *Squill*, *Calomel*, and *Digitalis*, are each powerful Diuretics, but nevertheless they cannot be considered *similar* remedies, since *Digitalis* will entirely fail in its effects in the very cases that *Calomel* and *Squill* succeed; and *Squill* will prove inert when *Digitalis* is capable of producing the most powerful influence; this arises from their modes of operation being dissimilar, and consequently requiring for their success such different states of the living system. *Squill*, it will be seen, acts *primarily* on the urinary organs, by stimulating the secreting vessels of the kidneys; *Mercury*, on the contrary, acts primarily on the absorbents, and *secondarily* on the kidneys; whereas *Digitalis* produces its effects by diminishing arterial action, and increasing that of absorption.

Dr. Blackall, in his "Observations upon the Cure of Dropsies," has offered some remarks so valuable in themselves, and so illustrative of

* Dr. Majendie goes so far even as to assert, that by varying the different preparations of the *same* Narcotic, we shall be better able to keep up its action on the animal œconomy, without an increase of its dose. He adds, "Some English writers have denied the truth of this observation; but they have not given any reason for their scepticism—*Why should it not be true?*"

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this important subject, that I shall take leave to quote the passage. "Many physicians," he observes, "are fond of combining *Squill*, *Calomel*, and *Digitalis*, as a diuretic in dropsy; a practice unsafe, and not very decidedly possessing the merit even of being consistent. *Digitalis* greatly depresses the action of the heart and arteries, and controls the circulation, and it seems most unreasonable to believe that its curative powers can be independent of such an effect: on the other hand, *Mercury*, if it does not pass off quickly, is always exciting fever, and raising and hardening the pulse; speaking from experience, where the urine is coagulable, and *Digitalis* agrees, both the others are, often at least, positively injurious. On the contrary, where the urine is foul, and not coagulable, and *Squills* with *Calomel* render service, I have on that very account, made less trial of Digitalis, and cannot therefore speak of it from much experience." See *Form.* 103, and the *note* thereon.

The individual medicines which compose the class of DIAPHORETICS vary no less in their primary operations, as the synoptical arrangement at *page* 101 very fully exemplifies; thus, in the cure of intermittent fevers, diaphoretics are useful both in the paroxysm, and during the intermission; in the first case they shorten its duration; in the second they support the tone of the extreme vessels, and prevent its recurrence; but in these opposite states of disease a very different kind of diaphoretic is required—to fulfil the first indication, a cooling and relaxing one is necessary; to answer the second, the stimulating diaphoretic is exacted; the one may be said to *solicit*, the other to *extort* perspiration. So again EMMENAGOGUES can only be considered relative agents, since the suppression of the catamenia may depend upon, or be connected with, very different states of the system; in some cases with a diminished, and in others with an increased state of excitement; for on many occasions the suppression of the menses is the effect, and not the cause of disease; *Boerhaave* has very justly observed, that it is a most dangerous error to ascribe all the diseases of young females to a retention of the catamenia, which often do not appear because the patients are disordered from other causes. If, therefore, we were to attempt a combination of the several medicines which have gained reputation as *Emmenagogues*, it is very obvious, that we should bring together an assemblage of adverse and incompatible remedies; nor would the physician be less inconsistent were he to combine EXPECTORANTS, without a due regard to their modes of operation; it is only necessary to observe their classification, as presented at page 105, to become satisfied how greatly the success of such remedies must depend upon their scientific adaptation to each particular case.

The class of ANTISPASMODICS may likewise embrace remedies of the most opposite tendency, for spasms may occur under the most opposite circumstances—in an extreme condition of weakness, as in nervous affections, and in an highly excited state, as in colic, &c.; it is hardly necessary, therefore, to point out the mischief that must arise from the fortuitous and indiscriminate admixture of the individual substances which are thus unavoidably arranged in the same artificial classification. *Bark* and *Steel* are also too often considered as equivalent *Tonics;* in Dropsy, says Dr. Blackall, it is far otherwise, the former being infinitely to be preferred after the dropsy of young persons, of acute disease, and of sound stamina; the latter being suited to a vitiated rather than to a feeble habit, and indicated more by a pale sallow

complexion, and a want of red colour in the blood, as shown by the paleness of the lips, than by any other signs. Need we then adduce farther illustrations of the obvious but important fact, that the terms employed to denote the different classes of remedies are frequently but relative ones, expressive of effects which are produced only in reference to a particular state of the living body? and as this necessarily varies in different states of health and disease, it follows that medicines are convertible agents, and that when we attempt to institute general rules respecting their administration, without taking into consideration the constitution and circumstances of the patient upon whom they are to operate, we shall generally be disappointed in the result. We may say of medicines what Van Swieten said of diet, "to assert that such, or such a thing be wholesome, without a knowledge of the condition of the person for whom it is intended, is like a sailor pronouncing the wind to be fair without knowing to what port the vessel is bound." Boerhaave was so fully impressed with this truth that he exclaimed, "*nullum ego cognosco remedium, nisi quod tempestivo usu fiat tale.*"

Although medicines which produce the same ultimate effects by modes of operation obviously different, cannot be considered SIMILAR, in the sense affixed to the term in the present section, yet if these different modes of operation be not physiologically incompatible with each other, the union of such remedies may not only be admissible, but even useful; and it will, accordingly, constitute an object of inquiry in a succeeding section. (III. A.)

C.—*By combining the Basis with Substances of a* DIFFERENT NATURE, *and which do not exert any Chymical influence upon it, but are found, by experience, to be capable of rendering the Stomach, or System, or any particular organ, more susceptible of its action.*

Thus it is that the system is rendered more susceptible of the influence of Mercury, by combining it with Antimony and Opium.* Where the stomach is insensible to impressions, the exhibition of Opium previous to, or in combination with, any active medicine, often assists its operation: this is remarkably striking in some states of mania, when emetics will fail, unless the stomach be previously influenced and prepared by a narcotic; indeed, in ordinary cases of inirritability of stomach, the addition of a small quantity of opium will often render an emetic active.†

* It would even appear probable that in some cases mercurial influence has, after its subsidence, been renewed by doses of Opium; a remarkable instance of this kind is related in Hufeland's Journal (vol. ix.) in which an old woman is said to have fallen into a considerable salivation after every dose of Opium; she had previously applied to a physician for an extensive ulceration over her body, and had taken a considerable quantity of mercury; but the effects had subsided, until renewed by the Opium.

† It has been observed under the history of Emetics (p. 87), that in cases of profound intoxication, or in those of violent wounds and contusions of the head, vomiting will not take place, however forcibly the stomach may be goaded by an emetic, whereas if the brain be only partially influenced, as by incipient intoxication, or by a less violent blow on the head, its irritability is increased instead of being paralyzed, and that vomiting under such circumstances is excited by the slightest

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So again the system, when it is in that particular condition which is indicated by a hot and dry skin, is unsusceptible of the expectorant powers of Squill, unless it be in union with antimony or some powerful diaphoretic, (*Form.* 134.) Squill is by no means disposed to act upon the urinary organs, when exhibited singly; but calomel, and some other mercurial preparations,* when in conjunction with it appear to direct its influence to the kidneys, and to render these organs more susceptible of its operation; (103, 106.) Upon the same principle, *Antimonial Wine* quickens the operation of saline cathartics (69;) *Opium* increases the sudorific powers of *Antimony* (124;) and the purgative operation of *Jalap* is promoted by *Ipecacuan* (84.) Dr. Aikin asserts that fifteen grains of the former purgative when combined with two or three grains of the latter root, will purge more than double that quantity of Jalap when administered without such an adjunct.

Sir John Pringle speaks of the advantages which may be obtained by combining an alkali with a bitter infusion, by which the diuretic effects of the former will be increased, while the latter is calculated to remove any gastric debility, and to impart a general tone to the body: there is no doubt but that *Bitters*, from their invigorating influence upon the *primæ viæ*, (*see page* 81) increase the effects of remedies whose operation is connected with changes *in transitu*, or with absorption, as in the exhibition of certain diuretics;† they also frequently render the stomach and bowels more susceptible of bodies that act by impression, as purgatives, emetics, &c.

We may discover the operation of such a principle in some of the more active compounds presented to us by nature: many herbs owe their efficacy to a cause of this kind. *Elaterium*, as I have ascertained by experiment, contains a purgative element *sui generis*, (*Elatin*) and a bitter principle, which in itself is quite inert, and yet its presence in the compound renders the alimentary canal more susceptible of the impression of the active ingredient, and therefore increases its force. See *Extract. Elaterii.* The history of Senna will afford some interesting facts in farther elucidation of this subject; the leaves of this plant, like *Elaterium*, appear to contain an active principle, in combination with a bitter, which latter ingredient, although destitute of purgative properties, con-

causes; just so is it with regard to Narcotics, a powerful dose so paralyzes the nervous system, that the stomach cannot be made to reject its contents, as every one must have observed in cases of narcotic poisoning, while smaller doses, like lesser injuries of the head, dispose the stomach to sickness.

* Sir Gilbert Blane has advanced an ingenious hypothesis to explain the cause of the fœtid breath of persons under the influence of mercury; which might perhaps also show why certain remedies are rendered more efficient by combination with mercury. One of the active effects of mercury, says Sir Gilbert, is to *alter the natural sensibility of the Lacteals*, so that when under its influence, they absorb indiscriminately that which is excrementitious and nutritive; hence the smell of the breath, since the fœtid particles are carried into the circulation, and thrown off in the *halitus* of the lungs, or by the salivary glands, in consequence of the mouth of the lacteals losing that selecting tact, whereby in their sound state they reject whatever is offered to them, except the chyle. Now if mercury acts as the "*Soporata Offa*" to the lacteals, it is evident that its combination with active matter may, on some occasions, facilitate the absorption of the latter.

† In some cases, however, the energy of an active bitter would seem to be diminished by an alkali; and it may therefore be more prudent to administer such substances at different periods. I apprehend that the powers of *Squill* are thus invalidated by a fixed alkali.

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siderably increases those of the former; for if this be removed, as happens when Senna is transplanted into the south of France, the purgative principle is weakened, but may be again restored by the artificial addition of some bitter extractive. The fruit or pods of Senna* contain only the purgative principle, and are therefore comparatively feeble, unless the defect be compensated by art: Dr. Cullen has observed that a much smaller quantity of the leaves is required for a dose if they be infused in company with some bitter plant; and it has been found that the watery infusion of *Rhubarb* is rendered more purgative by the addition of *Calumba*.

The experiments of Seguin have established beyond all doubt that the active principle of vegetable astringents is a peculiar element, to which the name of *Tannin* has been given; but the efficacy of this ingredient is undoubtedly enhanced by the presence of the gallic acid with which it is usually associated, although this acid, when separated from the native combination, is incapable of producing the least astringent effect: that peculiar flavour which we so commonly experience in unripe fruits, and which we designate by the term *acerbness*, is the result of a combination of the astringent principle with some vegetable acid. The relative sweetness of sugar, when in different degrees of purity, depends upon the operation of the same law of combination; *pure sugar*, as Dr. Mac Culloch has very justly observed, however, paradoxical it may appear, *is not so sweet as that which is impure;* the sweetness of *molasses*, compared with that of refined sugar, is too well known to require more than a bare mention; the vegetable extractive matter in this case, increases the effect of the saccharine principle with which it is combined; for the same reason grapes, differing very materially in their proportion of saccharine matter, may seem *to the taste* equally sweet, and such in fact is the case on comparing the luscious grapes of Spain, with the *Chasselas* of Paris; and yet the vinous produce is entirely different, the result of the one being a sweet and luscious wine, while that of the other is hard and dry, because, in truth, these grapes contain very different proportions of sugar; and however powerfully the extractive matter may modify the effects of this principle upon the palate and organs of taste, it cannot alter the quantity of alcohol resulting from its fermentation.† Crystallized sugar also appears less sweet to the taste than loaf sugar, but this may depend upon the different state of aggregation, and, consequently, the different degrees of solubility possessed by the sugar in these two forms.

In some cases, the addition of certain bodies will induce the absorbents to admit and carry into the circulation remedies which, in a more simple state, they would reject as injurious; this position is supported by the fact of mercury being more readily absorbed when in combination with animal matter, see *Ung: Hydrarg:* and it is probable that iron, in the form of a *tanno-gallate*, will be more acceptable than when presented in a more purely mineral state: see *Ferri Sulphus*.

Does it not therefore appear from the preceding remarks, that *certain*

* The Arabian and Greek physicians scarcely noticed the leaves, but always employed the pods of Senna; a fact which will explain the operation of this plant, as observed by them.

† Mac Culloch on Wine. Edit. 2. p. 42.

*elements exist in the composition of vegetable remedies, as furnished by nature, which, although individually inert, confer additional strength and impulse upon the principle of activity with which they are associated.**

The solutions of saline cathartics appear likewise to gain an accession of power and celerity of operation by impregnation with *Carbonic acid gas*, depending probably upon the intestines thus receiving a degree of distention favourable to the action of the salt, (19, 23.) Certain it is that the operation of emetics, as well as that of glysters, is materially increased by the stimulus of distention.

In enumerating the methods to be adopted for increasing the energies

* If the facts stated in this section be true, we are bound to recognise two orders of medicinal elements,—the one comprehending those that possess an inherent and independent activity,—the other, those that are in themselves inert, but which are capable of imparting impulse and increased energy to the former when combined with them. As this is a new view of the subject of vegetable combinations, no apology is necessary for the introduction of new terms for its explanation; I therefore propose to designate the former of these SUBSTANTIVE, and the latter, ADJECTIVE constituents. When the structure of vegetable remedies shall have been thoroughly examined upon this principle of combination, much medicinal obscurity will be removed, and probably some pharmaceutical improvements of value suggested; at all events it will teach a lesson of prudent caution to the parmaceutic chymist; it will show the danger of his removing this or that element from a vegetable compound, merely because he finds, upon its separation, that it is inert. I dwell the more upon this point, because I feel that there never was a period in the history of medicine, at which such a caution was more necessary; for while the poly-pharmacy of our ancestors has driven the physician of the present day into a simplicity of prescription that on many occasions abridges his powers and resources, the progress of chymical knowledge has diffused through the class of manufacturing chymists a bold spirit of adventure and empiricism, —a mischievous propensity to torture our best remedies, in order to concentrate or extract the parts which they consider to constitute their essential ingredients.

A Memoir has lately been presented to the PHILOMATIC SOCIETY OF PARIS, by M. Robiquet, on the subject of *Aroma*, which affords some important analogies in proof of the law of combination, which I am now endeavouring to elucidate. From the experiments of this laborious chymist it would appear, that odours are not as Fourcroy supposed, *the effect of the simple solution of certain bodies in air*, but that for their developement, some third body (coinciding in its office with my ADJECTIVE constituent) possessing in itself none of the characteristic odour, is absolutely necessary as an intermede, varying in its nature according to that of each odorous body, in the same way that the mordant requires to be varied by the dyer, according to the nature of the colouring matter which it is intended to fix on the cloth;—thus Ambergris has in itself very little odour, but the addition of Musk developes a very strong and decided one; this also happens in a less degree with Lavender, and the perfumers therefore add a small quantity of musk to the distilled water of this plant. In other cases, Ammonia lends, as it were, its volatility to bodies, the odour of which without such an auxiliary, would be scarcely sensible; this is exemplified by the practice of perfumers exposing their musk and other substances to the atmosphere of privies when they lose their power; (*Paul Amman: Manduct: ad Mat: Med:*) so again in order to give pungency to snuff it is made to suffer the commencement of fermentation, in which case ammonia is generated; and it is a curious fact that the odour of the best snuff may be destroyed by mixing with it a little tartaric acid, by which its ammoniacal salt is neutralized. In some instances the *adjective* ingredient seems to be Sulphur, as in the essential oils of some cruciform plants, and particularly in that of mustard seed, for M. Robiquet found that this oil lost its odour by being kept in contact with a metallic surface, and that an inodorous oil remained, while the metal became a sulphuret: perhaps, adds M. Robiquet, it may be sometimes necessary for the full and exquisite developement of odour in these bodies to add another vehicle, thus the addition of a little Acetic acid heightens the odour of mustard.

Iron has little, or no odour; but when volatilized with hydrogen, its odour is very powerful. The smell of copper and brass must depend upon some circumstance not well understood.

of a remedy, by rendering the system more susceptible of its action, it is right to know that, under certain circumstances, Venesection deserves a distinguished rank amongst the ADJUVANTIA. The fact is strikingly discovered in the exhibition of *Mercurial** *Preparations*, and some other alterative medicines. Whether the "*Vis Conservatrix*," which Nature, when in a state of health and vigour, opposes to the admission of poisonous substances into the circulation, be overcome by blood-letting, is a question which I shall leave others to decide; but thus much reiterated practice has taught me, that the system in a strong and healthy condition frequently is overcome the moment the stomach becomes deranged, the circulation languid, or the general tone of the system impaired. I have frequently seen this during my Hospital practice: if a patient who has been using mercurial friction, or taking the preparations of that metal without effect, be transferred into a close and unhealthy ward, his appetite soon fails, the tongue becomes furred, and the system instantly yields to the influence of the remedy. Nauseating doses of *antimony*† frequently repeated, or the accidental supervention of any disease of debility, will be attended with the same phenomena. My practice has also afforded me an opportunity of appreciating the debilitating effects of despondency in a case of this description; a patient had been taking mercurial medicines, and using frictions for a considerable period, without any apparent effect; under these circumstances he was abruptly told that he would fall a victim to his disease; the unhappy man experienced an unusual shock at this opinion, and in a few hours became violently salivated.‡

VENESECTION, moreover, increases the effects of cathartic medicines. I have often noticed this fact in contending with a plethoric diathesis;

* Astruc and other practitioners of the same school, always premised a mercurial course with venesection: it is probable that many of the anomalies observed in the modern application of this remedy may have arisen from an inattention to the diet of those who are under mercurial influence. Mercury is in itself a most powerful stimulant, and ought therefore to be accompanied with depletion and low diet; besides which, the experiments of Majendie have shown how greatly such a state of the system will expedite the effects of the mercurial remedy.

† Dr. Eberle, of Philadelphia, in a work lately published, has quoted the above passage, and remarks, that he has long been acquainted with the fact which it announces; although he proposes to account for it by a different train of reasoning; he considers that Nauseants encourage mercurial ptyalism, by favouring an afflux to the salivary glands. The learned author must allow me to congratulate him upon this fortunate discovery; unless his patients be blessed with as much apathy as was ever assumed by the Gilbertine order of Benedictines, he need never in future despair of influencing them by mercury. He has only to condemn the refractory to meagre fare, and then to tantalize them, as poor Sancho was, in his government, with the sight or rather smell, of a savoury dish, and he will without doubt secure his object,—but, to be serious, if Dr. Eberle's views be correct, how will he explain the modus operandi of *fear*, as related in the text? for the tendency of fear is to *diminish* the salivary secretion as will be hereafter mentioned.

‡ Fear, contrary to joy, decreases, for a time, the action of the extremities of the arterial system, as is seen by the sudden paleness which succeeds, and the shrinking or contraction of the vessels of the skin. M. de Haen relates the case of a painter who suffered convulsions, which were succeeded by a return of his colic. In this case the poison which had been, for a long time, admitted into his constitution in consequence of his daily employment, was, by the passion of anger, immediately brought into action. It was formerly observed by Citois, that the inhabitants of the province of Poitou, who had suffered anxiety of mind on account of any misfortune to themselves or family, were particularly susceptible of the disease.

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whenever the bleeding preceded the purgative, the effects of the latter have been uniformly more speedy and considerable; in obstinate constipation the same fact has been observed, and mild remedies have been known to act more powerfully, when preceded by blood-letting, than potent ones have when exhibited antecedent to it. Venesection has certainly an extraordinary power in awakening the susceptibility of the *primæ viæ* to remedial impressions; in some diseases, as in the *Cynanche Trachealis*, or Croup, so great is the insensibility of the stomach, that Emetics frequently fail in their effects; and Dr. Hamilton has given as much as a hundred grains of *Calomel* in the twenty-four hours: in such cases previous venesection affords most extraordinary assistance. Dr. Fothergill also remarks that emetics are more beneficial after bleeding, (*Dissert. Med Inaug. de Emet. usu.*) The effects of *Bark*, *Steel*, and other tonics, are certainly influenced in the same manner; whether in any case it may be prudent or judicious to have recourse to such a practice, is a question not immediately connected with the present inquiry.

Limited must have been the experience of that practitioner who has not frequently witnessed the utility of Venesection in producing a state of system favourable to the operation of various remedies. In acute diseases, how frequently does an opiate succeed in allaying irritation after copious bleeding, which could not be made to occasion any beneficial influence previous to that operation? In Pneumonia I have repeatedly seen such a plan of treatment act like a charm upon the patient.

Purgatives also awaken the susceptibility of the body to mercurial impressions, and it is remarked by Dr. Chapman that this practice affords a resource which rarely disappoints the practitioner. This class of remedies moreover seems capable of exalting the efficacy, and indeed of accelerating the benefit to be derived from many alteratives, when administered *previous* to the exhibition of these latter substances; the advantages of a course of Steel medicines are undoubtedly increased by such means. The febrifugous and antiseptic properties of diluted muriatic acid (see *Form.* 145.) are inconsiderable, unless its exhibition be accompanied with catharthics. I beg to refer the practitioner to some cases published by me in the *Medical and Physical Journal for December*, 1809, in further illustration of these views. Experience enables me also to state that *Diuretics* are considerably assisted by similar means, having many instances in my case book of the failure of these agents before, and their successful operation after, the exhibition of a cathartic. Dr. Darwin observes that "*Absorptions are always increased by Inanition*," and in support of this position refers to the frequent advantage derived from evacuations in the cure of ulcers. I have certainly seen obstinate sores in the leg cured by small and repeated bleedings. Dr. Chapman arrives at the same conclusion, although by a different train of reasoning; he states that the blood-vessels and absorbents* are to a certain extent "antagonizing powers:" instructed by this obvious fact, we ought, says he, in the exhibition of diuretics, to regulate the state of the system by interposing purgatives, or even venesection, as the state of the circulation may indicate.

* How admirably do the results of Majendie's Experiments coincide with this reasoning; see page 86; and yet Dr. Eberle, in a work quoted below, appears unwilling to admit such a theory.

Emetics also, in certain conditions of the system, would appear to render the stomach more sensible to the impression of other remedies; Dr. Eberle, of Philadelphia,* has remarked such an effect with respect to the administration of the Peruvian Bark.

Change of Diet and of Habits may be also classed amongst the *Ajuvantia*, but the young practitioner must be warned that he is not to exercise his *Caduceus* as Sancho's Doctor did his wand. I have seen a young disciple of Esculapius so vex his patient, that his food became more nauseous to him that his medicine, and I verily believe his Physician was more irksome than his disease. It is well observed by Dr. Percival that the prejudices of the sick should never be contemned with wantonness, or opposed with harshness; for, silenced by authority, they will operate secretly and forcibly on the mind, creating fear, anxiety, and watchfulness. And with regard to diet it may be here stated, that no function of the body is so materially influenced by mental impressions as that series of actions constituting what is termed *Digestion*—the unexpected communication of any distressing event destroys the keenest appetite† and converts the sensation of hunger into one of disgust at the bare idea of food; a fact which did not escape the penetrating eye of our immortal Shakspeare, for he represents Henry dismissing Wolsey from his government with these words—

> ———Read o'er this;
> And after, this: and then to breakfast
> *With what appetite* you have.

If feelings of disgust are excited by the repast, the stomach will never act with healthy energy on the ingesta; and in cases of extreme aversion, they are either returned, or they pass through the alimentary canal almost unchanged: on the other hand, the gratification which attends a favourite meal is in itself a specific stimulus to the organs of digestion, especially in weak and debilitated habits. Dr. Merriman has lately communicated to me a case which affords a striking illustration of the powerful influence of the mind upon these organs: a lady of rank labouring under menorrhagia, suffered with that irritable and unrelenting state of stomach which so commonly attends that disease, and to such a degree that every kind of aliment and medicine was alike rejected: after the total failure of the usual expedients to appease the stomach and procure relief, she applied to Miss Prescott, and was *magnetised*, when she immediately, to the astonishment of all her friends, ate a beef steak, and continued to repeat the meal every day for six weeks, without the

* A Treatise of the Materia Medica, and Therapeutics, by J. Eberle, M. D. In two volumes. Philadelphia, 1822.

† In the same manner is the salivary secretion immediately influenced by the operation of the mind; the sight of a delicious repast to a hungry man is not more effectual in exciting it, than is the operation of fear and anxiety in repressing and suspending it. Whence we are led to believe, that the Hindoo Ordeal by Rice may have occasionally assisted in the ends of Justice. This ordeal was conducted in the following manner. The persons suspected of any crime being assembled in a ring, a certain portion of dried rice was given to each, which they were directed to chew for some minutes, and then to turn it out of their mouths upon the leaves or bark of a tree. Those who were capable of returning it in a pulpy form were at once acquitted, while those from whose mouths it came out dry, were pronounced guilty. See Medical Jurisprudence, Introduct. Vol. 1, p. viii.

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least inconvenience! but the disease itself, notwithstanding this treacherous amnesty of the stomach, continued with unabated violence, and shortly afterwards terminated her life.

The diet of a sick person ought never to *combine too much nutriment in too small a space;** when so given it will even in health be followed by *fermentation* instead of *digestion;* and although we may admit the expediency of that domestic maxim, "*a little and often*," yet this is to be received with limitation; no one, for instance, who possesses any philosophical knowledge, will adapt his practice to the notions of Sir William Temple, who asserted that "the stomach of a valetudinarian was like a school-boy, always doing mischief when unemployed," and that we should therefore not allow it any interval of repose: to this I answer, that the conversion of aliment into blood is effected by a series of elaborate processes, several of which are only perfectly performed during the quiescence of the rest: it would seem, for instance, that the process of *chylification* is incompatible with that by which the first changes are produced in the stomach; this is evident from the well-known fact, that our appetite for food ceases when the former process commences, although the repast should, at the time, have been insufficient to satisfy the craving of nature: whereas, in diseases of imperfect, or depraved digestion, as in *Diabetes*, *Tabes Mesenterica*, *&c.*, we find that the appetite for food is never satisfied by the most nutritive meals. It merits notice also, that whenever the stomach be called into action during the assimilating stages of digestion, the process will, in weak persons, be much disturbed, if not entirely suspended. These views have long since confirmed me in the propriety of treating mesenteric affections in a manner very different from that which is generally pursued; and I may add that the result has been very satisfactory. The plan to which I allude, consists in enforcing longer intervals between each meal, which should be scanty, and in quantity short of what the appetite may require; in this way are the unwilling absorbents induced to perform their duties with greater promptitude and activity; but it is a practice, which, from the extreme anxiety of friends and relatives, the feelings of craving and hunger expressed by the patient, and the mistaken but universal prejudice respecting diet, it is always painful to propose, and generally impossible to enforce; where, however, circumstances have given me a full and unreserved control, the advantage of the plan has been most decisive.

* The capacity of our digestive organs sufficiently testifies that nature never intended them for the reception of highly concentrated food, while this idea is farther strengthened by perceiving how sparingly she produces concentrated aliment; the saccharine matter of esculent fruits is generally blended with acidulous and mucilaginous ingredients; and the oleaginous principle of seeds, kernels, and other similar substances, is combined with farinaceous matter: the capacity observable in the organs of graminivorous animals evidently shows that they were also designed for a *large bulk* of food, and *not* for provender in which the nutritive matter is concentrated; the gramineous and leguminous vegetables do not present their nutritive matter in a separate state, nor is the animal furnished with an apparatus by which he can separate the chaff and straw from the grain,—the obvious inference is, that he was intended to feed indiscriminately on both.

Some years ago I constructed a Logometric scale of Equivalents, analogous in principle to that which I have now introduced under the title of the "MEDICINAL DYNAMETER," to show the relative nutritive strength of different vegetables, and to work problems connected with them; I soon found, however, that unless *bulk* was taken into calculation, it was incapable of furnishing even an approximation to truth.

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There is still another remark which I am desirous of offering, in this place, on the subject of Diet; *viz.*—that in all cases of feeble or imperfect digestion, *the valetudinarian ought never to take his principal meal in a state of fatigue*—and yet let me ask, whether there is a habit more generally pursued, or more tenaciously defended? Aye, and defended too upon *principle*—the invalid merchant, the banker, the attorney, the government clerk, are all impressed with the same belief, that after the sedentary occupations of the day, to walk several miles to their villas, or to fatigue themselves with exercise before their dinner, or rather early supper, will sharpen their tardy stomachs, and invigorate their feeble organs of digestion. The consequence is obvious,—instead of curing, such a practice is calculated to perpetuate, and even to aggravate the malady under which they suffer; by calling upon the powers of digestion at a period, when the body is in a state of exhaustion from fatigue. Often have I, in the course of my practice in this town, cured the Dyspeptic invalid, by merely inducing him to abandon so mischievous a habit.

II.

TO CORRECT THE OPERATION OF THE BASIS, BY OBVIATING ANY UNPLEASANT EFFECTS IT MIGHT BE LIKELY TO OCCASION, AND WHICH WOULD PERVERT ITS INTENDED ACTION, AND DEFEAT THE OBJECTS OF ITS EXHIBITION.

A. *By* Mechanically *separating, or* Chymically *neutralizing, the offending Ingredient.*

The scientific physician, from his knowledge of the chymical composition of a medicine, and of the principles upon which its different qualities depend, is enabled to remove or render inert the element which imparts to it a deleterious operation; thus it has been found that the peculiar principle in the *Spanish Fly*, which so frequently irritates the urinary organs, is soluble in boiling water; ebullition in water therefore offers the means of depriving it of the power of thus acting upon the kidneys, while it does not effect any alteration in its vesicatory properties. It is upon the same principle that many vegetable substances of a very acrid nature, become harmless by boiling, or by chymical manipulation, and some of them might even in times of scarcity and want, be introduced as wholesome and nutritious articles of diet. The experiments of *Westring* show that the bitterness of the *Lichen Islandicus* may be entirely removed by maceration in an alkaline ley, and a tasteless, but highly nutritious fecula be thus obtained; in the same manner the *Æsculus Hippocastanum* (Horse Chestnut) may be deprived of its bitterness, leaving a residuum which will afford a kind of bread; and according to *Parmentier* (*Recherches sur les vegetaux nourisans,*) excellent starch may be also made from it. *Dr. Darwin* observes, that if the roots of *White Bryony* be rasped into cold water, and agitated with it, the acrid juice of the root along with the mucilage will be dissolved,

or swim in the water; while a starch perfectly wholesome and nutritious will subside, and may be advantageously used as food; by a similar species of address the French prepare from the acrid *Arum* the harmless, but highly prized cosmetic, called *Cyprus powder*.

There are many substances which receive a much pleasanter mode of operation by having their solubilities increased or diminished; thus the griping occasioned by several drastic purgatives is obviated by the addition of some alkali; and the nauseating tendency of *Camboge*, which arises from its too easy solubility, is prevented by incorporating it with some insoluble body; as in the *Pilulæ Cambogiæ Comp:* but the farther consideration of this question will be resumed in the fourth section of the Analysis. (iv. c.)

Numerous attempts have been made to correct the inconvenient effects of *Opium*, such as nausea, headach, and costiveness, by removing the resinous element, upon which such evils have been supposed to depend, and we have accordingly been at different times presented with a variety of *Formulæ* for the accomplishment of so desirable an object; *(see Opium.)* More recently, opium has been discovered to possess *two* active principles, viz. *Morphia* and *Narcotine*, which would appear from the researches of M. Majendie to exert very different powers upon the animal system; the former imparting to opium its *soporific*, the latter, its *exciting* properties; whence it is proposed to remove this latter principle in order to render the operation of opium milder, and at the same time to divest it of those objectionable properties which so greatly limit its medicinal utility. *See Opium.*

B. *By adding some substance capable of guarding the stomach, or system, against its deleterious effects.*

The virtues of our most important remedies are frequently lost, or much invalidated, for want of proper attention to the circumstances comprehended in this section. It may be almost admitted as an axiom that *whenever an* ALTERATIVE *medicine acts with violence upon the primæ viæ, its energies are uselessly expended, and the object of its exhibition defeated.* So again, *Diaphoretics*, *Diuretics*, and many other remedies, suffer a diminution in their effects, whenever they stimulate the stomach or bowels to excess. *Guaiacum* thus loses its anti-arthritic, *Squill* its diuretic, and *Antimony* and *Ipecacuan* their diaphoretic, virtues; the action of these substances may therefore require correction, and a medicine must be selected capable of fulfilling that intention. *Opium* has very extensive powers as a corrigent. *See Form.* 57, 100, 106, 110. Dr. Mead combined alkaline salts, when intended to act as diuretics, with opium, in order to prevent their action upon the bowels. *Acetate of Lead*, when administered in cases of hæmopthysis, or uterine hemorrhage, should also be guarded by the addition of a small portion of the same narcotic. Dr. Sutton, of Greenwich, has lately written a paper to show, that where we wish to limit the operation of an emetic to the stomach, and to prevent its action on the bowels, we should add five or six drops of laudanum to the emetic draught, which in his experience has answered the purpose in question.* The griping and nauseat-

* Med. Repos. Nov. 1822.

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ing tendency of some remedies receives correction by the addition of *Aromatic stimulants*, or *Essential oils*, (69, 71, 78, 84, 85, 92,) or by small portions of a corresponding tincture, (70, 76.) It has been already stated, that the griping from *Senna* and *resinous* purgatives may be, in a great degree, obviated by the addition of alkalies; it remains to be observed, that the same remedies are also mitigated in severity, by *Saline* purgatives, (77.) I learn from Sir Henry Halford, that in his practice he has found the addition of *Extract of Hyoscyamus* render the operation of the *compound extract of Colocynth* much more mild, and no less efficacious. Of the value of such a combination, I am myself able to bear ample testimony. *Alum* is corrected in its tendency to disturb the bowels by the addition of *Nutmeg*, (*Form.* 53,) or some aromatic; and the drastic operation of *Colocynth* may be mitigated by trituration with *Camphor*. There are several substances which are deprived of their acrimonious qualities by trituration with mucilage, milk, barley-water, &c. The tendency which mercurial preparations possess of affecting the bowels, is, with the exception of *Corrosive Sublimate*, corrected by *Opium*, but the acrid operation of this latter salt is more securely guarded against by the decoction of *Guaiacum* or *Mezereon*, or by the plentiful exhibition of mucilaginous drinks and broths. In certain diseases of the uterus and vagina, astringent lotions are indicated, but it may happen, as in the cauliflower excrescence, or in the oozing tumour of the labium, that such applications are too irritating; in such cases the effect of the lotion is *corrected* by the addition of mucilage. The enfeebling influence of *Digitalis*, *Tobacco*, and some other narcotics, is successfully opposed by aromatics and stimulants. It has already been stated that several attempts have been made to correct the operation of *Opium* by the application of mechanical and chymical resources; it would, however, appear that, for obviating its effects upon the intestinal excretions, the judicious addition of some purgative will offer the most effectual corrigent; and, according to my own experience, the *Aloetic* preparations are to be preferred upon such an occasion, as in *Form.* 11, 12, 13. In some cases, I have found that a combination of the watery infusion of *Opium* with some bitter, will secure the narcotic virtues without those consecutive effects upon the alimentary canal, which we are always so desirous to obviate; the *Decoctum Aloes compositum* also furnishes upon such an occasion a very appropriate adjunct. Let us remember that one of the effects of opium is to paralyze, for a time, the muscular fibres of the intestines: now experience has taught us that the remedies above directed have a peculiar tendency to augment the peristaltic motions of the *primæ viæ*. Upon the same principle the addition of calomel will prevent the paralyzing influence of this narcotic upon the biliary functions. I have known several patients who could never take opium unless in such a form of combination.

In general, a formula contains but one *corrigent;* but circumstances may occur, where two different ingredients are required to obviate two very different effects, as in *Form.* 16, in which the *Nitric Acid* is introduced for the purpose of counteracting the deleterious effects of the opium upon the nervous system, while the *Aloetic* preparation is calculated to obviate its particular tendency upon the alimentary canal.

Sometimes the unpleasant or perverse operation of a medicine may be obviated by changing the form of its exhibition, the period at which it is

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taken, or the extent of its dose; Dr. Cullen, for instance, found that the nauseating operation of *Cambogæ* might be obviated, by repeating small doses at short intervals. (89.)

Before quitting the present subject, it deserves notice, that there is frequently a *chymical* condition of the stomach that may interfere with the mild operation of a medicine, and may therefore require consideration: this is particularly exemplified in the action of those antimonial preparations which are liable to become emetic and drastic by the presence of an acid; it is, for this reason, very eligible to guard such substances with antacid adjuncts. See *Antimonii Sulphuretum*, and *Form.* 125, 128. There is also, upon some occasions, an irritable state of the *primæ viæ* depending upon a deficient secretion of mucus, which renders even small doses of any active medicine mischievous; mucilaginous decoctions in such a case will offer the readiest *corrigent;* see *Scammonia.*

The vinous infusion of *Colchicum* appears to act more violently when acid is present in the stomach; small doses of *Magnesia* may therefore precede, and accompany, its exhibition, with advantage.

III.

TO OBTAIN THE JOINT OPERATION OF TWO OR MORE MEDICINES.

A. *By uniting those substances which are calculated to produce the* SAME ULTIMATE RESULTS, *although by totally different modes of operation.*

It has been already stated, (*page* 156,) that we may frequently combine substances together whose modes of operation are dissimilar, with considerable advantage, provided they be not physiologically incompatible with each other. We may illustrate this subject by a reference to the operation of purgatives; a series of medicinal substances may be produced, each of which has the property of exciting catharsis, but by a very different mode of action; one for instance stimulates the muscular fibres of the intestines; a second acts upon the exhalent vessels, and mucous glands; and a third exerts its influence upon the neighbouring organs, so as to produce an increased flow of their secretions into the bowels; but since such modes of action are quite compatible with each other, they may be simultaneously established, not only without any loss of efficacy, but with the most decided advantage: suppose for instance we administer a substance which, either from its insolubility or peculiar nature, acts exclusively upon the muscular fibres of the alimentary canal, its peristaltic motions will be undoubtedly thus increased, and the contents of the bowels evacuated, but the operation will be slow, and probably, accompanied with considerable *tormina;* now it is evident that if to such a remedy we add those which can produce an increased flow of serous fluids, the effect will be both quicker and easier. *The infusion of senna* is thus quickened and corrected by *Soluble Tartar.* In the same manner various substances included in the class of diuretics, which, although different,

still if they be not adverse in their operation, may be conjoined; *Digitalis* and *Potass* are not similar, nor are they incompatible, for while the alkali, through the medium of the circulation, stimulates the secreting organs of the kidneys, the foxglove may, by its sympathetic action, rouse the energy of the absorbents. In the administration of diaphoretics, we shall frequently derive additional force, as well as certainty, by combining those which act by relaxing the cutaneous emunctories, with those which prove diaphoretic by imparting a general increase of momentum to the blood.

B. *By combining Medicines which have entirely different powers, and which are required to obviate different symptoms, or to answer different indications.*

Arrangements constructed upon this principle constitute some of the most valuable remedies with which we are acquainted; they are in general *extemporaneous*, because their very value depends upon their being varied and modified according to the symptoms and circumstances of each particular case. The following general elucidation of the subject may serve to demonstrate the nature and importance of such combinations.

Purgatives *with* Antispasmodics. The practice suggested by Drs. Stoll and Warren, in the treatment of *Cholica Pictonum*, affords a striking example of the expediency of combinations of this nature. It is found in that disease, as well as in others attended with spasmodic constriction of the intestinal canal, that purgatives produce no effects unless the spasm be allayed by combining them with *Opium*, (*see Form.* 71, 75, 76,) it is from such a cause that the purgatives so popular with tailors a d shoemakers, and which consists of *Aloes* with *Sagapenum* or *Galbanum*, affords such prompt relief in the spasmodic colic to which they are subject.

Purgatives *with* Tonics. In the exhibition of cathartics how frequently it occurs in practice that the patient's strength will hardly allow the evacuation; in such a case the addition of *steel* as a roborant (*Form.* 72, 92, 93,) or even of *æther*, or *ammonia*, as a diffusible stimulant, is strongly indicated: the Cheltenham waters offer a natural combination of this character. So again in the cure of dropsy we have often two indications to fulfil—to evacuate the water, and to support the strength of the patient; hence the necessity of combining brisk and stimulating purges, such as *Scammony*, *Jalap*, &c. with active tonics, (83.) In the treatment of amenorrhæat he same medicinal arrangement is not unfrequently indicated.

Purgatives *with* Mercurial Alteratives. In habitual costiveness, where there appears to be a deficiency of bile, a combination of *Pilula Hydrargyri*, with certain *Aloetic* compounds, may prove serviceable; for while the latter remedy, will, in the absence of bile, supply to the intestines a congenial stimulus, the former will tend to restore the bilious secretion by its influence upon the hepatic system. *See Form.* 79, 81.

Purgatives *with* Diaphoretics. This combination of effects is often useful in practice, but it is desirable that the latter should not be established until the operation of the purgative upon the bowels has subsided.

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This is accomplished by certain doses of *Tartarized Antimony* in conjunction with some purgative. The *Pulvis Aloes Compositus* of our Pharmacopœia produces a somewhat similar effect.

Diaphoretics *with* Tonics. How frequently is the practitioner desirous of determining to the skin and at the same time of supporting the strength of the general system? in the progress of a continued fever we are repeatedly called upon to fulfil such indications. Dr. Bree* also observes that "in the exhibition of *Diaphoretics* the addition of a bitter infusion, or tincture, is frequently proper; for the stomach should be gently excited and strengthened during the use of a diaphoretic draught." On the other hand, *Tonics* not unfrequently require the aid of a diaphoretic; for instance, in the cure of *Cynanche maligna*, the use of bark is indicated; but if the skin be hot and dry, it should be accompanied with a diaphoretic. *See Form.* 126.

Antispasmodics *with* Tonics, *or* Narcotics. Under the history of Antispasmodics, (*page* 80) it is stated that there are certain bodies which seem to exert an absolute control over inordinate muscular action, from whatever general cause it may have arisen; in administering such remedies, however, the intelligent practitioner will not overlook the peculiar condition of the system in its relations to the disease; where debility is present, the *Antispasmodic* will be usefully combined with a *Tonic;* and, in certain morbid states of the nervous system, with a *Narcotic.*

Astringents *with* Diaphoretics. Dr. Fordyce has observed, that combinations of this kind are often indicated in cases of Diarrhœa, where it is necessary to astringe the vessels of the intestines, and at the same time to relax those of the skin; such an indication, he says, may be fulfilled by exhibiting *Tormentil root*, or any other vegetable astringent, with *Ipecacuan.*

Astringents *with* Narcotics, and Absorbents. It has been already observed, that in a Diarrhœa, depending upon the influx of acrid fluids into the intestines, there are three modes of treatment by which the malady may be obviated, viz. by a narcotic, *diminishing the irritability of the intestines;* by an astringent, *restraining the serous excretion;* and by an absorbent, *neutralizing the acrid matter.* As the modes of action are not incompatible with each other, they may be simultaneously established with the greatest advantage. *See Form.* 52.

Astringents *with* Tonics. A combination of certain medicines belonging to these two classes is frequently indicated; in the treatment of passive hemorrhage, we have to astringe the bleeding vessels, and, at the same time, to cure the hemorrhagic diathesis by remedies which are capable of restoring the general tone of the system. In the treatment of the chronic and humid coughs of old persons, I have very frequently witnessed the beneficial union of the warm and stimulating influence of *Myrrh* with the astringent effects of *Sulphate of Zinc. Form.* 69 presents the combination which I have usually adopted with success on such occasions.

Diuretics *with* Tonics. As Dropsy is frequently associated with great debility, the practitioner should combine his diuretics with some tonic medicine; but in forming a judgment upon the case he must be

* A Practical Inquiry into Disordered Respiration, p. 243.

guided by those precepts which have been laid down under the consideration of Diuretics at page 100. See *Form.* 114.

Diuretics *with* Aromatic Stimulants. Such a combination will be found advantageous in those cases where the powers of the system require to be excited by more prompt measures than those afforded by the agency of tonics. *Ethereal* preparations, with Squill and other stimulating diuretics, are well calculated upon such occasions to afford valuable assistance. *Form.* 101—116.

Tonics *with* Diffusible Stimulants. In the cure of dyspepsia, we frequently require a remedy, for the purpose of obviating debility, that is more sudden in its action, and prompt in its effects, than that of a bitter *tonic*, whose operation is almost imperceptible; while the case may at the same time stand in need of that permanent increase of tone, which the latter remedy can alone supply; such an indication therefore must be fulfilled by combination. *Form.* 40, 42.

Tonics *with* Purgatives. In the exhibition of tonic medicines it is frequently essential to accompany their operation with purgation; in intermittent fevers, for instance, when attended with a redundant secretion of bile, or any obstruction of the viscera, the *bark* must be given in combination with some laxative, for which purpose Boerhaave has recommended *Muriate of Ammonia;* Mead, *Rhubarb;* whilst in many cases, experience suggests the propriety of selecting some of the warmer cathartics, especially the *Alöetic;* and I shall take this opportunity to observe, that notwithstanding the opinion so strongly expressed by Sydenham, that, "*to add any thing to the bark argues either ignorance or craft,*" the most respectable testimony may be adduced to demonstrate the great advantages which have arisen from the various combinations of this heroic remedy. Sir George Baker has said that "*there is less of reason than of severity*" in the above remark of Sydenham; for that it was found in the cure of the intermittent fever, which he describes, that, according to circumstances, sometimes the *Virginian snake root*, and in other cases *Myrrh*, were added with propriety and advantage; and, according to the experience of several practitioners, a drachm of the *rust of iron*, and the same quantity of the powder of *black pepper*, added to each ounce of *bark*, were the means of subduing the most inveterate agues. *Formula* 44 presents a combination, which we learn from Dr. Petrie's letter to Sir George Baker, constitutes a celebrated Dutch remedy for an ague, and which was tried with success in the hospital at Lincoln, in those obstinate intermittents which prevailed in the year 1781. Hillary speaks of an epidemic intermittent at Barbadoes, in which the bark was of no avail, unless combined with saline remedies, or some of the tonic bitters. Dr. Barton has stated that Bark combined with Mercury in a small proportion, is one of the best remedies for removing the swelling of the spleen after an intermittent.

Expectorants *with* Diffusible Stimulants. We have seen that expectorants may be usefully associated with tonics; it sometimes occurs that these remedies require the addition of some diffusible stimulant. In certain states of *Peripneumonia notha*, where the powers of life are ebbing, and the lungs become inundated with viscid mucus, I have experienced the value of a combination of some stimulating expectorant and *ammonia.*

Antacids *with* Tonics. In the cure of cardialgia we have obviously

two indications; to neutralize the offending acid by some chymical agent, and to correct the morbid state of the digestive functions by some appropriate remedy. *See Form* 152. The same observation will apply in the treatment of certain cases of chlorosis, where cardialgia is not unfrequently a very vexatious attendant, and solicits the union of emmenagogues with antacids, or absorbents, as in *Form.* 99.

Lithontriptics *with* Narcotics. As a palliative in calculous irritation, the union of alkalies and opium proves a valuable resource. Henbane may likewise be advantageously combined with a Lithontriptic; for, be it remembered, that few narcotics are more efficacious in allaying nephritic irritation. (*Form.* 156.) We have also frequently two important indications to fulfil in the treatment of urinary concretions; where the lithic acid diathesis prevails, it will be necessary to neutralize any acidity in the first passages, and at the same time to regulate the functions of the skin; we have moreover to give tone to the digestive organs; so that, in such cases, the art of medicinal combination is well calculated to extend our resources.

In the formation of these compounds we should rarely attempt to fulfil more than two indications, although cases may occur in which it will be eligible to assail the disease with an engine of *triple* powers, as exemplified by *Form.* 52.

In constructing, however, such complex arrangements the practitioner must of course take care that he does not fall into the error of Contraindication, and combine substances which possess properties essentially different, and which are at variance with, or directly opposed to each other; it is an error of the most serious description, and unfortunately is one of too common occurrence in the lower walks of medical practice; "*crimine ab uno disce omnes.*" I lately met with a country practitioner who, upon being asked by a lady whom he attended, the intention of three different draughts which he had sent her, replied, that one would warm, the second cool her, and that the third was calculated to moderate the too violent effects of either; thus it is that discredit and contempt fall upon the use of medicines, which ought only to attach to the ignorant pretenders, or designing knaves who administer them.

Having, in the commencement of this inquiry, stated that all the principles of combination, capable of practical application in the construction of extemporaneous formulæ, are exemplified in the composition of the various productions of nature, I shall conclude the present section by showing, that *many of our most valuable vegetables owe their useful properties to the joint operation of the several distinct and different ingredients which enter into their composition.* How many substances does nature produce in the vegetable kingdom, in which the permanent tonic quality of bitterness exerts its influence in union with the transient stimulating powers of an aromatic principle? indeed there is a series of vegetable remedies of this kind: commencing with those that are simply bitter, we gradually proceed through the different species, each blending as we advance an increasing proportion of aroma, until we arrive at those in which the aromatic quality greatly preponderates. *Peruvian Bark* may be said to combine within itself the properties of *bitterness, astringency*, and *aroma;* a fact which suggested the probability of our being able to produce an artificial compound that might emulate the effects of Cinchona, and to a certain extent the idea appears to have been realized;

for we are told by Dr. Cullen that he frequently succeeded in the cure of an intermittent by a combination of *Oak Bark* and *Gentian*, when neither bitters nor astringents, separately, produced the least impression; and I am informed by Dr. Harrison, that in the Horncastle Dispensary, of which he was for many years physician, he never employed any other remedy for curing the ague of Lincolnshire than equal parts of *Bistorta*, (astringent) and *Calamus Aromaticus* (bitter and aromatic) neither of which plants, *individually*, ever produced the least benefit in such diseases. Berzelius attempted to produce a compound of this description by adding to the bark of the *Ash* some *Tormentil root* and *Ginger*; and he observes that it acted as an excellent tonic, and that according to the experiments of his friends it seemed to cure quartan agues.* In the aromatic barks and woods such as those of the *Canella*, *Orange-peel*, *Sassafras*, *&c.*, the aromatic principle† is combined with a bitter ingredient; a union which proves of singular service in the formidable bowel complaints so common in tropical climates.

The great superiority of the hop, as an ingredient in our malt liquors, depends upon the fact of its containing within itself several distinct and independent elements of activity, which the other bitter herbs that have at different times been employed as its substitute, do not possess. The philosophy of its operation may be adduced as a striking illustration of the present subject; first then, it contains a *bitter* principle, which imparts to the beverage a tonic quality and an agreeable flavour; while at the same time an *aromatic* ingredient adds a warm and stimulant property and modifies the bitterness; the hop, moreover, contains an *astringent* ingredient (*Tannin* and *Gallic Acid*,) the effects of which are to precipitate the vegetable mucilage, and thus to remove from the beer the active principle of its fermentation; every attempt therefore to substitute an ordinary bitter for that of the hop must necessarily fail, unless a compound can be so artfully constructed as to contain in due proportions, the principles of bitterness, astringency, and aroma. *Quassia* must therefore necessarily prove but a sorry substitute; it will impart bitterness enough, but it will not be modified by agreeable aroma; and as it contains no astringent principle, it will fail in precipitating the vegetable mucilage, or gluten; in consequence of which the beer so manufactured will be in a perpetual state of fermentation until it is entirely spoilt.‡ *Rhubarb* is another medicinal plant which may be brought forward in elucidation of the analogies subsisting between natural and artificial combinations; in this case Nature has presented us with a singular and most important union of medicinal powers,—that of an astringent, with a cathartic property! virtues, which we might, without the light of experience, have pronounced to be incompatible with each other; and yet we find that in this instance the property of astringency never interferes with, or opposes the purgative force, since the former does not display itself unless the substance be administered in small doses; or, when given in larger ones, not until it has ceased to operate as a cathartic.

* Dr. Young's Medical Literature, Edit. 2. p. 570.

† The vegetable kingdom presents us with many natural compounds of this kind; several of which might be pressed into the service of medicine with much advantage. With respect to the number and variety of such substances, it must be confessed that our Pharmacopœia contains but a meagre bill of fare.

‡ The same reasoning will explain why English hops, that contain more Gallic Acid and Tannin than those imported from the Continent, are found to be superior as preservatives of beer.

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IV.

TO OBTAIN A NEW AND ACTIVE REMEDY NOT AFFORDED BY ANY SINGLE SUBSTANCE.

A. *By combining medicines which excite different actions in the Stomach and System, in consequence of which* NEW, *or modified results, are produced.*

This constitutes by far the most obscure part of the subject of medicinal combination, and must ever continue so until we become better acquainted with the laws which govern the action of medicinal substances upon the living system. That the most valuable effects, however, are really produced by such arrangements, we have the testimony of long experience, and examples are furnished in the valuable and well known operation of many officinal preparations; thus the "*Pulvis Ipecacuanhæ compositus*" contains as its active elements, *Opium* and *Ipecacuanha;* and yet, in well regulated doses, it neither possesses the narcotic operation of the former, nor the nauseating effects of the latter; they appear to be mutually lost, and converted into a powerful diaphoretic: so again, the emetic operation of *Sulphuret of Antimony*, and the specific influence of *Calomel*, are changed by combination with each other, giving rise to a remedy eminently distinguished for its powers as an alterative. Dr. Bree observes that *Tincture of Squills* combined with *Extract of Henbane*, and the *Nitric Acid*, have been proved by much experience to be expectorant and sedative in a paroxysm of asthma, although each article, uncombined, had been given without success. See *Form.* 139. The efficacy of *Hemlock*, in quieting Pulmonary irritation, has been frequently adverted to in the course of this work; I have to state, in this place, that its value, on such occasions, is generally enhanced by combination with *Ipecacuanha*.

It is probable that many of our natural remedies owe their efficacy to the results of a similar species of combination. In the fourth edition of this work it was stated that, according to the assertion of Dr. Chapman, "*Kino*, when administered in union with *Calumba*, constituted a pretty certain and powerful purgative;" since the publication of this fact, I have investigated what, if true, would appear to be a most extraordinary anomaly in the philosophy of medicinal combination, and I find that the statement of Dr. Chapman* is not borne out by experiment. That we might arrive at a just conclusion upon this subject, I requested the assistance of my friend Dr. John Davy, whose character for experimental accuracy, and whose situation as Superintendent of the Medical Division of the General Military Hospital at Chatham, seemed to point him out as a person peculiarly adapted for such an inquiry; the result of his trials does not establish that of the experiments of Dr. Chapman, but on the contrary it seems to prove, that neither *Kino* nor *Calumba*, when taken separately, has a constipating effect, and that in the form of powder (especially the *Calumba*) each has an aperient quality, which is not

* Therapeutics, vol. 2, p. 470.

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increased by exhibiting the two medicines together in a state of mixture. The trials from which these inferences are drawn were made on different individuals in tolerable health, and they were repeated more than once; in some cases they were given separately, and in others, mixed together, in doses varying from a scruple to a drachm of each.

B. *By combining substances which have the property of acting chymically upon each other; the result of which is the formation of* NEW COMPOUNDS, *or the decomposition of the original Ingredients, and the developement of their more* ACTIVE ELEMENTS.

A. *The Formation of New Compounds.*

It is not necessary to extend our researches beyond the range of the Pharmacopœiæ,* to collect a variety of interesting and important examples, in illustration of this division of our subject; if we require a striking example of the agency of chymical combination in destroying the identity of the original constituents, and of giving origin to a compound of new powers, it may be exemplified by the well known instance of *Sulphate of Potass*, a substance possessing but a weak affinity for water, and exerting but little energy upon the animal economy; whereas the two ingredients of which it consists are distinguished for the extreme eagerness with which they unite with water, and for the caustic activity which they display in their action upon animal matter.

Under this head the class of metals will also present itself to our consideration, all the individuals of which, with the exception perhaps of iron, are perfectly inert and harmless; even arsenic, lead, copper, and mercury, which in certain states of combination constitute some of the most virulent of known substances, exert no action upon the living system, unless they be in union with some other body; but when so united, how valuable do they become, and what various medicinal effects may they not be made to produce.

The *Acetic Acid* and *Ammonia* become neutralized by combination with each other, affording a compound of new virtues. *Sulphate of Zinc* and *Acetate of Lead*, when mixed together in solution, decompose each other, and the *Acetate of Zinc* which is formed, affords a more valuable remedy than either of the former salts, as an application in ophthalmia. The "*Mistura Ferri Composita*" of our Pharmacopœia offers another example of the same chymical resource. I also beg the reader to refer to the construction of *Formula* 82, which presents an instance of a purgative draught being produced by combination, in which the original properties of every element are entirely changed. See also *Formula* 87, the chymical actions of which are more complicated, but no less instructive than the preceding one; the ingredients of the formula are the *Carbonates of Soda* and *Magnesia*,—*Sulphate of Iron*,—*Diluted Sulphuric Acid*, and *Water*—and when mixed together, the following decompositions would appear to take place; the free *Sulphuric Acid*, together with that which exists in the *Sulphate of Iron*,

* This subject has been ably illustrated by Mr. R Phillips, in his translation of the London Pharmacopœia, by a series of very striking and instructive diagrams.

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being just sufficient to decompose the *Carbonates of Soda* and *Magnesia*, forms two neutral *Sulphates* (viz. *Sulphates of Soda* and *Magnesia*,) and thereby disengages a volume of *Carbonic Acid gas*, which not only increases the purgative operation of the new saline compounds, but, by its excess, holds in solution the *Carbonate of Iron*, which is formed by the decomposition of the *Sulphate*, and which in that state displays an effect powerfully tonic.

Before we quit the consideration of medicinal compounds as the results of chymical action, it is expedient to remind the practitioner of the essential difference between *Mixture* and *Combination*, a difference which affects the medicinal virtues no less than the chymical characters of bodies; it is determined by ample experience, that substances will produce effects upon the living system when presented in a state of simple mechanical mixture, very different from those which the same medicines will occasion when they are combined by the agency of chymical affinity, as is well exemplified in the comparative effects of alcohol as existing in ardent spirits, and in wine (see *Vinum;*) or in the relative powers of *Mercury* in the *Unguentum Hydrargyri* of the London College, and the *Unguentum Oxidi Hydrargyri cinerei* of the Pharmacopœia of Edinburgh, (see *Unguent. Hydrargyri:*) the former of which is a true chymical compound, whereas the latter is a simple mixture of its ingredients.

B. *The Developement of Active Elements.*

The accomplishment of such an effect is in many instances the sole object of a pharmaceutical process. It is thus that we obtain pure *Citric Acid* from the juice of the Lemon; *Tartaric Acid*, from Cream of Tartar; *Benzoic Acid*, from the resinous substance known by the name of *Gum Benzoin;* upon the same principle, the *Muriatic* and *Nitric* acids are elicited from the saline compounds in which they exist. *Ammonia*, in its pungent form, is developed from its inodorous *Muriate;* and the fixed alkalies are obtained in their caustic state, from the comparatively mild *carbonates* in which they naturally exist. But a more striking and instructive instance of the effect of chymical action, in developing an active, or useful principle, cannot perhaps be selected than that of the well known stimulant Plaster, composed of *Muriate of Ammonia*, *Soap*, and *Lead Plaster*, in which the alkali of the soap enters into combination with the muriatic acid, when the *Ammonia*, upon which the virtues of the plaster solely depend, is slowly disengaged in the form of gas, producing a powerfully rubifacient and stimulant effect; the "*Cataplasma Fermenti*," or "*Yest Poultice*," is indebted for its antiseptic properties to a similar agency, for they do not depend upon any virtue in the ingredients themselves, but upon their decomposition, and the consequent developement of an active element, which is *Carbonic Acid*. The practitioner unacquainted with the *modus operandi* of these combinations, would inevitably fall into an error by which their efficacy must be lost; he would hardly apply them as soon as they were formed, nor would he be aware of the necessity of repeating them at short intervals.

The decomposition of *Calomel* by lime water, forming the well known "*black wash*," and that of *corrosive sublimate* in the same fluid, con-

stituting the "*aqua phagadenica*," furnish remedies which derive all their peculiar efficacy from the developement of the mercury in different states of oxidation. The reader will find another, and a very striking illustration of the same principle in the history of "*Alterative Drops*," under the article "*Hydrargyri Oxy-murias*."

A substance separated by chymical precipitation is often a valuable remedy, being in a much more subtle and impalpable form than any body can be rendered by mechanical triture and levigation;* for example, the *Carbonate of Lead*, (Cerussa,) when diffused in water, is according to the experience of our best surgeons, far less active as a topical application than the same substance when produced at once by precipitation from the *Sub-acetate* of that metal. In some cases, also, the substance obtained by precipitation is in a different state of oxidation from that which is prepared by a different process, see *Mist. Ferri comp*: It is a question well worthy of consideration whether a more active preparation of the *Antimonial powder* might not be formed by obtaining the oxide by the precipitation of *Tartarized Antimony*.

Many interesting and important illustrations have been lately afforded by an extended knowledge of vegetable chymistry, recent analyses having developed principles of extreme activity from several of our most esteemed plants; thus have Sertuerner and Robiquet succeeded in separating a narcotic element from *Opium (Morphia;)* Majendie, and *Pelletier*, an emetic principle from *Ipecacuan, (Emeta;)* and the last mentioned chymist, together with Caventou, a tonic one from *Peruvian Bark, (Cinchonia,)* the properties and applications of which will be fully explained in a subsequent part of this work, under the history of the different substances which contain them.

It is only here necessary to caution the practitioner against those fallacies into which the captivating theories of the chymist may seduce him; and, if the views which I have offered upon the subject of combination be correct, it will follow as a corollary, that the concentration *of an active element must in many cases abridge its powers as a remedy;* for although the matter thus removed may *individually* be quite inert, yet, in combination, it may subdivide the particles of the essential constituent, or modify its solubility, and give impulse and steadiness to its operation; thus the vegetable alkali *Quina*, although it indisputably constitutes the active matter of bark, will be found inefficacious when separated from it, unless it be rendered soluble by the addition of sulphuric, or some other acid.

C. *By combining substances, between which no other chymical change is induced, than a diminution, or an increase, in the* SOLUBILITIES *of the principles, which are the repositories of their medicinal virtues.*

The degree of solubility possessed by a medicinal substance may perhaps be regarded by some practitioners as a circumstance of but little or no importance; it will however appear in many cases that *it not only influences the activity of a remedy, but, like its dose, goes far to determine its specific operation;* indeed, where a medicine is not, in itself,

* See my work on Medical Chymistry: Sect. Precipitation.

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very soluble, the increase of its solubility by any chymical expedient, is tantamount to an increase of its dose.

It is probably owing to the diversity which exists in the solubility of the active elements of certain purgatives, that so great a diversity occurs in their operation; it is, for instance, easy to conceive that a medicine may act more immediately and specially on the stomach, small, or large intestines, according to the relative facility with which its principles of activity enter into solution; that those which are dissolved before they pass the pylorus are quick and violent in their effects, and liable to affect the stomach, as is exemplified by the action of *Gamboge*, &c., whilst some resinous purgatives, on the other hand, as they contain principles less soluble, seldom act until they have passed out of the stomach, and often not until they have reached the colon. *Colocynth* has a wider range of operation, since its principles of activity reside both in soluble and in insoluble elements. *Aloes* again, being still farther insoluble, pass through the whole alimentary canal before they are sufficiently dissolved, and act therefore more particularly upon the rectum, by which they are liable to produce piles, tenesmus, and the various effects which so usually attend their operation. The characteristic effects of *Rhubarb*, *Senna*, *Saline Cathartics*, and indeed of all individual substances which compose the class of the purgative medicines, will also admit of a satisfactory explanation from the application of these views. It ought moreover to enable the practitioner, by changing the solubilities of these substances, to change their medicinal effects. Experience shows that this is the fact, and that it may be effected either *by the intervention of substances that act* CHYMICALLY; or, *by the addition of Ingredients whose operation is entirely* MECHANICAL; thus by combining *Aloes* with *Soap* or an *Alkaline Salt*, we quicken their operation, and remove their tendency to irritate the rectum; the *Compound Decoction of Aloes* affords a combination of this kind. *Gamboge*, whose too ready solubility it is an object to obviate, should be intimately incorporated with some insoluble purgative, as for instance *Aloes;* a formula of this nature was introduced by Dr. George Fordyce, and it has been since simplified and admitted into our Pharmacopœia, under the title of "*Pilulæ Cambogiæ Compositæ.*" *Tartrate of Potash*, which, on account of its comparative solubility, has gained the name of *Soluble Tartar*, acts with corresponding briskness upon the small intestines; but by increasing its proportion of *Tartaric Acid*, we convert it into a *super-tartrate* or "*Cream of Tartar*," which is a substance characterized by a comparative degree of insolubility, and a correspondent change is produced in the medicinal activity of the salt; its purgative effects are considerably diminished, whilst its diuretic powers are rendered more considerable. We may even extend this experiment by adding to the *Cream of Tartar*, *Boracic Acid*, a substance capable of increasing to a certain extent its solubility, when we shall again find that its purgative properties are strengthened in an equal proportion.

It has been observed that a mixture of different saline cathartics is more efficient than an equivalent dose of any single one, a fact which is strikingly exemplified in the prompt and active operation of Cheltenham Salts, in comparatively small doses, as well as in that of sea water. I submit whether this may not in some degree depend upon increased solubility; for it is a law well known to the chymist, that *when water has*

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ceased to act upon a salt, in consequence of its having obtained the term of saturation, the solution may still take up another salt of a different kind. I apprehend that an advantageous application of this law might be frequently made in practice, and the energies of a remedy thereby considerably extended.*

Where the active principle of a cathartic is not sufficiently soluble, it is apt to vex and irritate the bowels, producing tormina instead of exciting a free and copious excretion; hence the reason why the operation of resinous purgatives is so commonly attended with griping, and why relief may be obtained by combining them with *neutral salts*. Thus also *Senna*, whose virtues reside in extractive matter, is apt by decoction, or long exposure to the air, to act with griping, in consequence of the extractive matter becoming by oxidation, resinous and comparatively insoluble; this effect is best counteracted by the addition of *soluble Tartar*, that will quicken its action, or by an alkaline salt that will increase its solubility.

It appears then to be established as a pharmaceutical maxim, that *the intensity and even specific action of a purgative medicine may be modified or completely changed, by changing the degree of solubility possessed by the principles in which its activity resides.*

The application of this principle is highly important in practice, directing us in the choice of the different purgatives, according to the objects which we may wish to fulfil by them, and pointing out safe and easy methods by which we may increase, diminish, retard, or accelerate their operation; it thus enables us to construct new and powerful combinations, by imparting to established remedies fresh activity, or by mitigating the acrimony and violence of arrangements in other respects efficacious and eligible.

In the exhibition of solid substances, their mechanical state of division may be capable of modifying their operation, from the influence which this condition must necessarily exert upon their solubilities, although I am by no means disposed to assign to it the importance which Gaubius has ventured to express, "*Sunt quæ ruditer pulverata alvum, subtilius vero urinas, aut alios humores movent;*" and Ray, speaking of the *Asarum* (Hist. p. 208) has the following remark—"*Quo tenuius est tritum, eo magis urinas movere minus autem alvum ducere creditur;*" and Linnæus† observes that this same plant, when exhibited in the state of *very fine* powder, uniformly acts as an emetic, but that when *coarsely* powdered it always passes the stomach, and becomes cathartic. M. Virey has made a similar observation with respect to Hellebore,—"*L'Hellebore pulverisé fait vomiter; concassé il purge; et en decoction prolongée, il en devient sudorifique ou diuretique.*" I have endeavoured under the article *Pulveres* to establish some useful precepts upon this subject, to which I beg to refer the reader.

The influence of solubility upon the medicinal energies and specific effects of remedies, may be farther illustrated by a comparative examination of the virtues of the *Acetate* and *Sub-acetate* (Goulard's Extract)

* An ingenious application of this law has been made for the purpose of purifying Epsom Salts. See *Magnesiæ Sulphas*; and also my work on Medical Chymistry. *Art*: *Solution*.

† Amœnitates Academ: T. 7. p. 307.

of Lead: the former preserves its solubility and integrity under any degree of dilution, while the latter, when slightly diluted with the purest water, in consequence of the carbonic acid diffused through it, gives out a copious precipitate; the acetate therefore is undoubtedly the more immediately active application as a preparation of lead, but it is nevertheless perhaps less adapted to remove inflammation and abate irritation than the turbid mixture of the sub-acetate, since the slow and gradual action which is ensured by the latter is more desirable than the instantaneous operation of the same remedy, applied in a more soluble form: the popular injection for gonorrhæa, consisting of a mixed solution of *Sulphate of Zinc* and *Acetate of Lead*, probably owes much of its value to the insoluble precipitate of *Sulphate* of lead which necessarily takes place, and which from becoming entangled in the mucus of the urethra, produces a more permanent stimulus than what could have happened from a soluble salt: (*Form.* 62) thus again the *Sulphuret of Antimony*, and some other preparations of that metal, of slow solubility, establish a more permanent influence than *Tartarized Antimony*, and may be preferable to it in cases where immediate and active evacuations are not required.

Of remedies composed of vegetable tonics, the useful application of this principle is also apparent. Thus the addition of *alkalies*, or *lime water*, to the infusions of *Gentian* &c., or to the decoctions of *Bark*, by rendering their extractive and resinous principles more soluble, increase their elegance, and exalt their virtues, (*Form.* 39, 41,) although this law admits of an important exception to be hereafter explained. A knowledge of this principle likewise offers many useful hints connected with the successful exhibition of active remedies; it points out the medicines which require dilution in order to promote their operation, and those whose too speedy and violent effects may be retarded and checked by an abstinence from all potation. Thus, in the exhibition of *Diuretics* likely to become cathartic or diaphoretic, no liquid should be given for at least an hour after their administration; the same caution applies with respect to the *Compound Powder of Ipecacuan*, which has a strong tendency to excite vomiting. When the remedy has passed out of the stomach, then the ingestion of fluids may, and ought to be encouraged.

To Sir Francis Milman the profession is highly indebted for hints concerning the importance of accompanying the exhibition of *Diuretics* with plentiful dilution,* the arguments he adduces elucidate in a very satisfactory manner the view which has been just taken of the Influence of Solubility.

The influence of solubility† in increasing the virulence of a poison-

* See also a paper in the Medical Transactions, vol. 2 entitled, "Several extraordinary instances of the cure of Dropsy, by George Baker, M. D. Read September 9, 1771."

† The most subtle of all poison—*the matter of febrile contagion*,—is certainly modified in activity by the degree of moisture in the atmosphere influencing its solubility; the Plague is said to be most common in Egypt after the inundation of the Nile, a period at which the atmosphere is necessarily saturated with water; according to the account of Sir Robert Wilson, the English and Turkish armies that marched to Cairo escaped contagion, while the troops that remained stationary on the moist shore of Aboukir, were very severely visited. On the other hand, the *Harmattan*, a wind experienced on the western coast of Africa, between the Equator and fifteen degrees *North Latitude*, blowing from northeast towards the Atlantic, and which, in conse-

ous substance, has already been illustrated very fully (*page* 139,) and it has also been shown under what circumstance it may be admissible. When these active substances are administered as remedies, in small doses, the precept respecting their solubility is even more important, for in such cases the smallness of the quantity places their operation more immediately under the control of various incidental agents; *destroy* the solubility of a medicine, and you will probably divest it of those properties which render it useful. *Nitrate of Silver*, by coming in contact with a *Muriatic Salt*, is rendered quite inert, and may be discovered unaltered in the fæces of persons to whom it has been administered. See *Argenti Nitras.*

Under the article *Plumbi Acetas* the practitioner will also find that the conjunction of this substance with any sulphuric salt, at once deprives it of its valuable properties as a remedy in *Hæmopthysis.*

Some practitioners, whose opinions I always receive with respect, have considered these views respecting the influence of solubility as savouring too much of the refinement of theory, and instances have been suggested which would appear to invalidate their pretensions; upon examination, however, it will be found that such exceptions are but apparent, and depend upon the solvent action of the gastric fluid. Thus the *Protoxide of Iron* would appear to be soluble in the fluids of the stomach, and is consequently an active medicine, whereas the *Peroxide* of the same metal, being insoluble under such circumstances, requires to be combined with an acid, as in the *Tinctura Ferri Muriatis*, to render it efficacious. The same remark will probably apply to the oxydes of antimony.

I shall conclude this section upon the influence of Solubility, by the relation of an anecdote which may tend to confirm the justness of the views I have offered, more satisfactorily perhaps than any additional arguments derived from a scientific examination of chymical and medicinal facts; in as much as it presents us with a practice, the utility of which has been discovered by unassisted experience, and must consequently be independent of theory. The American Indians, whenever they undertake a long journey, and are likely to be destitute of provisions, employ Tobacco for the purpose of counteracting the uneasy sensations of hunger, and in its preparation for such a purpose they adopt an expedient for modifying its powers, and protracting its effects, which affords

quence of its passage over a very extensive space of arid land, is necessarily characterized by excessive dryness, puts an end to all Epidemics, as the Small Pox; and infection at such a time does not appear to be easily communicable even by art. *Philosophical Transactions.* vol 21.

The difficulty of communicating infection to animals during a dry state of the air, as remarked on the Western Coast of Africa, during the blowing of the *Harmattan*, agrees with some observations on Plague by the French physicians, as this complaint first made its appearance in the French army during a moist state of the air in Syria, when it lay under the walls of Jaffa in February, 1800.

It is a well known fact that volatile bodies are sooner converted into a gaseous state by the presence of water in the atmosphere; this is strikingly exemplified by the greater rapidity with which *Limestone* is burnt and reduced to quick-lime in moist weather, and by the assistance which is rendered in a dry season, by placing a pan of water in the ash-pit; so again the perfume of flowers is most sensible when the air is humid, as during the fall of the evening dew, or in the morning when the dew evaporates, and is dissipated by the rays of the rising sun; for the same reason the stench of putrid ditches and common sewers, is conveyed to the organs of smell much more speedily in summer previous to rain, when the air is charged with moisture.

an instructive illustration of the influence of solubility; it consists in combining the juice of Tobacco, with the pulverized shells of snails, cockles, and oysters:* the mass is dried, and formed into pills, of a convenient size to be held between the gum and lip, which being gradually dissolved and swallowed, fulfil the intention required.†

V.

TO AFFORD AN ELIGIBLE FORM.

A. *By which the efficacy of the remedy is enhanced.*

After the views which have been submitted in the progress of the present inquiry, it is evident, that the *form* in which a remedy is administered may exert some influence upon its medicinal effects; for additional proofs of this fact, and for more particular directions, see *Decocta*, *Infusa*, *Tincturæ*, *Misturæ*, *Pilulæ*, *Pulveres*, &c.

When a substance, or a combination of substances, requires the addition of some other one, for the purpose of imparting a convenient, agreeable, or efficacious form, *a vehicle should always be selected, whose effects will be likely to correspond with the intention of the other ingredients.* This precept may be exemplified by a reference to *Form.* 80, 134, and others, the *key-letters* of which announce the *modus operandi* of their respective *vehicles.*

B. *By which its aspect or flavour is rendered more agreeable.*

It should ever be the object of the practitioner to accommodate, as far as he is able, the form and flavour of his medicines to the taste and caprice of his patient, provided always that he does not compromise their efficacy, and which often appears to be nearly connected with those sensible qualities which render them disgusting and objectionable.

Some medicines are more grateful to the stomach, as well as more efficacious in their operation, when exhibited in the state of effervescence. To effect this we have only to introduce an alkaline carbonate into the formula, and to direct a portion of some vegetable acid to be added just before it is swallowed. We must, however, take care that the ingredients are of a nature not likely to be decomposed by the alkali, in the first instance, or by the neutral salt, which is formed, in the second. See *Form.* 27, 82, 86.

* They are previously calcined, but not burnt to lime, to an extent only that may destroy their tenacity, and render them fit for levigation.

† A similar custom is common to the Indians of the whole of Asia, and of America; for the practice of the South American Indians, see *Humboldt's Personal Narrative.* In India, Betel, variously compounded, is employed for the purpose above stated. The mixture more commonly used in Ceylon consists of quicklime, Areca-nut, and Tobacco, wrapped in Betel leaf. On ordinary occasions it is only masticated; but to repress the painful calls of hunger, the juice is swallowed.

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C. *By which it is* PRESERVED *from the spontaneous decomposition to which it is liable.*

It is sometimes adviseable to add an ingredient for the purpose of preventing the sudden decomposition of a medicine; thus is the *Compound Tincture of Cardamoms*, added to the *Compound Decoction of Aloes*, in order that the latter may be preserved a longer period without change. The addition of sugar will prevent ointments from becoming rancid. Vegetable infusions, that are susceptible of mouldiness, are best preserved from such deterioration by some aromatic addition. For the knowledge of this fact we are indebted to Dr. Mac Culloch, who in a very interesting paper, lately published in the Edinburgh Philosophical Journal,* has observed, that perfume, such as *Essential Oils*, *&c.*, will prevent the production and growth of those minute cryptogamous vegetables, upon which the phenomenon of mouldiness depends.†

Such are the objects which are to be attained by combining several substances in one *Formula*, and such the laws by which these compositions are to be regulated; but unless a physician can satisfactorily trace the operation of each element in his prescription to the accomplishment of one or more of the objects which I have enumerated, SIMPLICITY should be regarded by him as the greatest desideratum. I was once told by a practitioner in the country that the quantity, or rather complexity of the medicines which he gave his patients, for there never was any deficiency in the former, was always increased in a ratio with the obscurity of their cases; "if," said he, "I fire a great profusion of shot, it is very extraordinary if some do not hit the mark." Sir Gilbert Blane‡ has given us a similar anecdote; "a practitioner being asked by his patient why he put so many ingredients into his prescription, is said to have answered more facetiously than philosophically, '*in order that the disease may take which it likes best.*'" A patient in the hands of such a practitioner has not a much better chance than the Chinese Mandarin who, upon being attacked with any disorder, calls in twelve or more physicians,

* Vol. viii. p. 33.

† Dr. Mac Culloch, in illustration of this subject, states, that ink, paste, and seeds, are among the common articles which suffer from such a cause, and to which this remedy is easily applicable. With respect to articles of food, such as bread, cold meats, or dried fish, it is less easy to apply the remedy, on account of the taste; cloves, however, and other spices whose flavours are grateful, may sometimes be used for this end. It is notorious that gingerbread, and bread containing carraway seeds, are far less liable to mouldiness than plain bread. The effect of cloves in preventing the mouldiness of ink is generally known; and the same result may be obtained by oil of lavender in a very minute quantity, or by any other of the perfumed oils. Russian leather, which is perfumed with the tar of the Birch tree, is not subject to mouldiness, as must be well known to all who possess books thus bound; they even prevent it from taking place in books which are bound in calf, and near which they may happen to lie. Paste is another perishable article, and although *Alum* which is used by the book-binder will certainly preserve it longer than it would remain useful without it, still it is not very effectual. *Rosin*, sometimes used by the shoemaker, answers the purpose better, and appears to act entirely on this principle; it is however far less effectual than even oil of turpentine; *Lavender*, and the other strong perfumes, as *Peppermint*, *Anise*, and *Bergamot*, are perfectly effectual, even in a very small quantity, and paste may be thus preserved for any length of time.

‡ Medical Logic, Edit. 2. p. 192, *note*.

and swallows in one mixture all the potions which each separately prescribes!

Let not the young practitioner however be so deceived: he should remember that unless he be well acquainted with the mutual actions which bodies exert upon each other, and upon the living system, it may be laid down as an axiom, that *in proportion as he complicates a medicine, he does but multiply the chances of its failure.* SUPERFLUA NUNQUAM NON NOCENT: let him cherish this maxim in his remembrance, and in forming compounds, always discard from them every element which has not its mode of action clearly defined, and as thoroughly understood.

The perfection of a Medicinal Prescription may be defined by three words; it should be PRECISE (in its *directions*,) CONCISE (in its *construction*,) DECISIVE (in its *operation*.) It should carry upon its very face an air of energy and decision, and speak intelligibly the indications which it is to fulfil. It may be laid down as a position which is not in much danger of being controverted, that *where the intention of a medicinal compound is obscure, its operation will be imbecile.*

A Medicinal Formula has been divided into four constituent parts, a division which will be found to admit of useful application to practice, in as much as it was evidently suggested with a view of accomplishing the more prominent objects which have been related in the preceding pages; or, in the language of Asclepiades, of enabling the BASIS to operate "CITO," "TUTO," et "JUCUNDE." Quickly, Safely, and Pleasantly—thus

I. THE BASIS, or Principal Medicine.
(*curare.*)

II. THE ADJUVANS; that which assists and promotes its operation.
("*Cito.*")

III. THE CORRIGENS; that which corrects its operation.
("*Tuto.*")

IV. THE CONSTITUENS; that which imparts an agreeable form.
("*Jucunde.*")

These elements however are not all necessarily present in every scientific formula, for many medicines do not require any addition to promote their operation, and the mild and tractable nature of others renders the addition of any corrective unnecessary; whilst many again are in themselves sufficiently manageable, and do not therefore require the *intermede* of any *vehicle* or *constituent.* It also frequently occurs that one element is capable of fulfilling two or more of the objects required; the ADJUVANS for instance, may at the same time act as the CORRIGENS, or CONSTITUENS; thus the addition of *Soap* to *Aloes*, or *Extract of Jalap*, mitigates their acrimony, and at the same time quickens their operation (80.) So again *Neutral Salts* both quicken and correct the griping which attends the operation of resinous purgatives. The dispo-

sition of the key letters placed opposite to the elements of the following *Formulæ*, will furnish the practitioner with a farther elucidation of these principles, viz. 70, 71, 76, 77, 101, 102, 105, 135, &c. This coincidence, if possible, should be always attained, for it simplifies the formula, and by decreasing the bulk of the remedy, renders it less nauseous and more elegant.*

This division also affords the best general rule for placing the ingredients of a formula in proper order, for the order should correspond with that of the arrangement; and those elements intended to act in unity should be marshalled together. The chymical and mechanical nature however of a medicinal substance will occasionally offer exceptions to any general rule; thus the volatile ingredients should be those last added, and the constituent or *vehicle* should be placed next the particular element to which it is intended to impart convenience or efficacy of form, or a capability of mixing with the other ingredients, as may be seen in Formulæ 69, 71, 127, 136, &c. This consideration induced the Committee, appointed to revise the late Pharmacopœia, to alter the order of the ingredients in the "*Mistura Ferri composita*," and to place the "*Spiritus Myristicæ*" next in succession to the "*Potassæ Subcarbonas*, and *Myrrh*. If any substance require decoction or infusion, a question then arises, determinable only by a knowledge of its chymical composition, whether the remaining ingredients should be added previous to, during, or subsequent to, that operation; *Formula* 40, which is recommended by Pringle as a remedy for Typhus fever, may serve to exemplify this principle. The preparation of the ingredients is resolved into three distinct stages, and it is easy to discover that by any other arrangement their several virtues could not be fully obtained, and secured from change. The *Cinchona*, for instance, yields its full powers only by decoction, a process which would necessarily impair those of *Serpentaria*, connected as they are with an essential oil; whilst the addition of the acid at any other stage of the process than that directed, would produce decompositions in the vegetable substances; and it is evident that were the *Spirits of Cinnamon* added previously, it would be entirely lost by vaporization. So in making the *Compound Decoction of Sarsaparilla*, the *Sassafras* should be added after the other ingredients have undergone boiling. The Decoctions of *Lichen Islandicus* and *Sarsaparilla* constitute a popular remedy on the Continent, in certain forms of Phthisis; now it is evident that as the former plant loses its virtues by long coction, and the latter requires a protracted ebullition for the extraction of its virtues, they ought not to be included under the same general directions, each decoction should be separately performed, and the results subsequently mixed.

* It appears from what has been stated under Section I. B. with respect to DIURETICS, that some medicines not only *assist*, but actually DIRECT the operation of the substances with which they may be associated, and that many remedies act in unison with those they are joined with: thus *Nitre* in conjunction with *Squill* is diuretic; in conjunction with *Guaiacum*, diaphoretic; for these reasons I hesitated whether I ought not to have added a fifth *constituent*, and restored the "*Dirigens*" of ancient authors; enough, however, has been said to enable the practitioner to appreciate the importance of such a law of medicinal combination.

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Compound Medicines have been divided into two Classes, *viz.*

I. Officinal Preparations:

which are those ordered in the Pharmacopœias, and kept ready prepared in the shops. No uniform class of medicines however can answer the indications of every case, and hence the necessity of

II. Magistral or Extemporaneous Formulæ.

These are constructed by the practitioner at the moment, and may be either arrangements altogether new, or officinal preparations with additions, or modifications. Too much importance cannot be assigned to the Art which thus enables the physician to adopt and graduate a powerful remedy to each particular case by a prompt and accurate prescription; without this knowledge, the practitioner of the nineteenth century, with all the collateral aid of modern science, will be as helpless in the chamber of sickness as the physicians of ancient Egypt, who were obliged by the laws to follow with servile exactness the unvarying mandates of their medical code. *Extemporaneous* are also preferable to *Officinal Formulæ*, whenever the powers of the compound are less liable to deterioration from being long kept; for examples, see *Mistura Ferri composita; Infusum Sennæ; Liquor Hydrargyri Oxymuriatis, &c.*

The Chymical and Pharmaceutical Errors, which may be committed in the composition on Extemporaneous Formulæ, are referable to the following Sources.

1.—*Substances are added together which are incapable of mixing, or, of forming Compounds of uniform and suitable consistence.*

This may be termed an error in the *Mechanism* of the Prescription, and has been generally regarded as being more inconvenient than dangerous, more fatal to the credit of the Prescriber than to the case of the Patient: the observations however which are offered in this work, especially under the article *Pilulæ*, must satisfy the practitioner that this error is more mischievous in its effects than has been usually supposed; it is so palpable and self-evident in its nature, that it will be unnecessary to illustrate it by more than one or two examples. *Calomel*, for instance, has been ordered in an aqueous vehicle, and certain *resinous tinctures* have been directed in draughts, without the necessary intervention of mucilage; so again, an intermixture of substances has been formally ordered in powder that possess the perverse property of becoming liquid by triture (see *Pulveres*,) and bodies have been prescribed in the form of

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pills, whose consistence* renders it impossible that they should preserve the globular form; or else they have been so hard and insoluble, that they might be fired through a deal board.† In the London Pharmacopœia of 1809, an error of this kind unfortunately passed without correction with regard to the Formula for preparing the *Syrup of Senna*.

II.—*Substances are added together which mutually decompose each other, whence their original virtues are changed, or destroyed.*

This is a more serious, but not a less frequent source of error; it has been already shown in this Analysis (IV. B) that the judicious and scientific application of chymical science has furnished new and endless resources to the physician, by exalting the efficacy and correcting the acrimony of established remedies, or by combining inert substances so as to create new and powerful medicines. With equal truth and confidence it may be asserted, that the abuse of these means not only destroys the virtues of the most valuable articles in the *Materia Medica*, but that the mildest remedy may be thus converted into an instrument of torture, and even of death. In a lecture delivered at Apothecaries' Hall, Mr. Brande stated that he had seen a prescription in which the *blue*, or mercurial pill, was ordered in conjunction with nitric acid, and that the patient was brought to "death's door" from the formation of *nitrate of mercury* in his stomach! I have myself lately seen a *Recipe*, professing to afford a preparation similar to the "*Black Drop*," and which directed a mixture of a *Tincture of Opium*, made with rectified spirit, with *Nitric Acid*; in this case, it may be very safely inferred that the author was not only ignorant of the chymical habitudes of these bodies, but that he never performed the experiment in question, or he would have learnt from dire experience, that in consequence of the rapid evolution of *nitric ether*, the contents of the phial will explode with violence, to the imminent hazard of the operator's eyesight. During the course of my professional practice I have witnessed more than an ordinary share of consumptive cases, and I can confidently state that in the treatment of Hæmopthysis, the styptic properties of *Acetate of lead* are entirely invalidated by combination with *Alum*,‡ or by its exhibition being accompanied with that of the acidulated *infusion of roses*, or with small doses of *sulphate of magnesia*; and yet, I would ask, whether this practice is not usual and general? The practitioner however cannot be too often reminded that he is not to reject a remedy whose value has been ascertained by experience,

* Dr. Percival in his Essays, ingeniously exemplifies this error by stating a case which occurred in his own practice. "I ordered," says he, "a combination of Camphor and Balsam of Copaiba in the form of pills, but the apothecary informed me that he was unable to form them into a mass, since they liquefied like treacle." I may here observe that the addition of a small portion of the coagulated yolk of an egg, would have rendered the mixture practicable.

† This would occur, if, in making the Pilulæ Ferri Compositæ, we were to substitute the Liquor Potassæ for the Sodæ Subcarbonas.

‡ The "Pharmacopœia Bateana" contains a Formula for a "Tinctura Anti-phthisica," which is stated to be "a truly good medicament in those consumptions which proceed from ulcers of the lungs." The following is the Receipt—℞. Sacch: Saturn: ℥j—Sal Martis ʒj—Infus: Spir: Vin: ℔j——Dose from twenty to forty drops. In this case an insoluble Sulphate of Lead must be formed, which will render the medicine, as far at least as its saturnine effects are concerned, completely inert!

merely because it appears to be unchymical: the popular and certainly useful pill, consisting of calomel, rhubarb and soap, may be adduced as an example of this kind. Of the *Mistura Ferri Composita*, I will only say that it is a most valuable combination; and whether it be the product of accident, or the result of philosophical induction, it equally deserves a distinguished place in our list of tonic remedies: but it cannot be denied that many of our esteemed arrangements, which are in apparent contradiction to all the laws of composition, owe their efficacy to the operation of affinities altogether blind and fortuitous.

It has been observed that the practice of combining certain vegetable tonics with lime-water, although very common, is in cases where we are desirous to obtain their *astringent* effects, of very doubtful propriety; for the fact is, that *Tannin* forms with the alkalies and alkaline earths, compounds that are *not* soluble in water,* and which are therefore probably inefficacious. It may perhaps be said that such an argument cannot avail, because if the astringent matter be even introduced into the stomach in its purest form, it will immediately form an insoluble compound on its contact with *gelatine*.† We know so little of the laws of *gastric chymistry*, that it is difficult to learn what changes take place in the animal laboratory; but it would seem probable that the powers of the stomach rather consist in decomposing the ingesta into simple forms, than in complicating them by favouring new combinations; besides which, if such a compound were formed, it would be subsequently decomposed *in transitu*; for the experiments of Sir H. Davy show that vegetable astringent matter passes through the body unchanged. (*Page* 84.)

It is impossible to furnish any general rule that may enable the practitioner to avoid mixing together substances which are incompatible with each other; a knowledge of their chymical habitudes must in every case direct him, and these are enumerated in the second part of this work, under the history of each medicinal substance. The physician however will find it useful to retain in his remembrance the simple and beautiful law which has been so ably developed by the eminent author of the "Statique Chimique," that *whenever two salts in a state of solution are brought together, which contain, within themselves, elements capable of producing a soluble and insoluble salt, a decomposition must necessarily arise*;‡ he illustrates this law by the example of *Nitrate of Silver* and *Muriate of Potass*, whose elements are capable of forming within themselves a soluble salt, *Nitrate of Potass*, and an insoluble salt, *Muriate of Silver*. It deserves also to be remembered, that a table of chymical affinity will not upon all occasions prove to the medical practitioner an unerring pilot; in those cases for instance, where a *super or sub salt is*

* This fact has been very satisfactorily proved by the failure of the practical attempts which were made by Dr. Macbride of Dublin, to improve the art of tanning leather by the use of Lime-water, instead of plain water, which he conceived would extract the virtues of Oak Bark more completely. The reader who is desirous of a more detailed account of this plan must refer to Phil. Trans. Vol. lxxiii. part 1, Act. 8.

† We trust these observations will not create any alarm in the worthy Citizen; he may, with as much safety as pleasure, continue the laudable practice of regaling himself and friends with a cup of strong tea, in spite of the Turtle soup they may have taken, and that too without the least danger of converting their stomachs into tanneries, or their food into leather.

‡ For a highly ingenious, and important extension of these views, see Aqua Marina. (Note.)

readily formed, a substance less weakly attracted by another than a third, will sometimes precipitate this third from its combination with the second, thus in the production of *Nitric Acid*, we decompose the *Nitrate of Potass* by virtue of the superior affinity of the *Sulphuric Acid* for its base, the nitric acid is accordingly disengaged, and a *Sulphate of Potass* remains in the retort; now, paradoxical as it may appear, if nitric acid be poured upon the *Sulphate of Potass*, a quantity of nitre will be reproduced, in consequence of the saturation of a portion of the base, in such a proportion as to enable the remaining atoms to form a *Bi-Sulphate of Potass.* In the same manner the *Tartrate of Potass* (Soluble Tartar) is, contrary to the usual affinities, decomposed by all *sub-acid* vegetables, which neutralize a *portion* of the base, and convert the salt into the *Bi-tartrate of Potass* (*Cream of Tartar.*) The same effect is even produced by *Carbonic acid.**

There are besides certain cases wherein *Triple Salts* are produced, which afford apparent exceptions to the usual affinities of the bodies involved in the combination; we have a very good illustration of this truth in the decomposition of the *Liquor Ammoniæ Acetatis* by *Magnesia;* if the practitioner refers to a table of affinities, he will perceive that *Acetic acid* has a greater attraction for *Ammonia* than for *Magnesia;* but if upon this assurance he were to administer these bodies together, he, or his patient, would soon discover that ammonia is developed with considerable pungency; now in this case the *Magnesia* forms a *Triple Acetate* with one part of the ammonia, and consequently sets the remainder at liberty.

A popular error exists with respect to the subject of chymical incompatibility, against which it may be here adviseable to caution the inexperienced prescriber, viz. that *no important change is produced, on the admixture of solutions, unless precipitation is occasioned.* This however occurs only when the new compound produced is insoluble; thus *Sulphuric Acid* may be added to *Lime-water*, by which a *Sulphate of Lime* is formed, but as its proportion is not too large for the water to dissolve, no precipitate occurs; so again, a solution of *Nitrate of Silver* is not apparently disturbed by the addition of *Ammonia*, because the resulting *Ammoniuret* is a soluble compound. We should, nevertheless, commit a great error in supposing that, for such a reason, these bodies were not *incompatible.* On the other hand, the medicinal powers of a solution are not necessarily destroyed by the occurrence of a precipitate, although such a result should always be regarded with suspicion.

III.—*The Methods directed for the preparation of the Ingredients are either inadequate to the accomplishment of the object, or they change and destroy the efficacy of the substances.*

The observations already offered upon *Formula* 40, will sufficiently explain the nature of the various errors comprehended under this head:

* M. Dive, an apothecary of Mont de Marson, has lately announced that a current of carbonic acid, when passed through a solution of Tartrate of Potass, partly decomposes it; and he ascribes to the same agent the production of the Bi-tartrate in the juice of the grape during its fermentation; accordingly, by mixing neutral tartrate with fermentable materials, we shall produce Cream of Tartar in the fermented liquor. Journal de Pharm. Octob. 1821. p. 487.

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so, again, if the virtues of a plant reside in *essential oils*, which are easily volatilized, or in *extractive matter*, which readily becomes oxidized, DECOCTION must necessarily destroy its efficacy; a striking example of this fact is presented us in the history of the *Laurel* and *Bitter Almond*: the poisonous influence of the essential oil and distilled water of these vegetable substances is well known, but their watery extracts are perfectly innocuous. A still more familiar example is to be found in the onion, or in garlic, which by simple coction is deprived of all its acrimonious qualities. On the other hand, an error equally injurious would be committed, by directing a simple infusion of a vegetable, whose medicinal properties depend upon resino-mucilaginous principles. Orfila found that an extract of Hemlock, prepared by boiling the dried powder in water and evaporating the decoction, was entirely destitute of activity. See *Decocta*, *Infusa*, *Extracta*.

An instance of the baneful effects which may arise from an erroneous method of preparation happened some time ago to fall under my immediate notice and care; it was in preparing an infusion of the root of the *Veratrum* with *Opium*, as directed by Mr. James Moore, when the dispenser ignorantly substituted a spirituous for a vinous menstruum.

A very common error may be here noticed, which is that of prescribing a substance in such a form, as not to be acted upon with any effect by the solvent; as an example it may be stated, that in preparing an infusion of *Juniper Berries*, unless pains be taken by strong contusion to break the seed, it will contain but little power as a medicine.

The unbruised seeds of Mustard were commended by Dr. Mead,* in Ascites, and by Bergius, in Intermittents; Dr. Cullen, however, has very properly observed that the seeds given in the above manner are never broken down or dissolved in the stomach, but pass away entire by stool, and cannot therefore occasion any beneficial result.

It is unnecessary to multiply examples in proof of the numerous errors into which a physician must unavoidably fall, who presumes to compose prescriptions without a knowledge of the chymical habitudes of the different substances which he combines. The file of every apothecary would furnish a volume of instances, where the ingredients of the prescription are fighting together in the dark, or at least are so adverse to each other, as to constitute a most incongruous and chaotic mass.

> "Obstabat aliis aliud: quia corpore in uno
> Frigida pugnabant calidis, humentia siccis,
> Mollia cum duris, sine pondere, habentia pondus."
>
> *Ovid Metamorph.* lib. 1. 19.

THE DOSES OF MEDICINAL SUBSTANCES are specific with respect to each, and can therefore be only learnt from experience; the young and eager practitioner, however, is too often betrayed into the error of supposing that the powers of a remedy always increase in an equal ratio with its dose, whereas THE DOSE ALONE VERY OFTEN DETERMINES ITS SPECIFIC ACTION. "*Medicines*," says Linnæus, "*differ from poisons, not in their nature, but in their dose*," which is but a paraphrase of the

* In one remarkable case related by this Physician, the operation of the unbruised mustard-seed is stated to have been promoted by combining it with a decoction of *Broom-tops*. Query, Was not the adjunct in this case the only efficient part of the remedy?

well known aphorism of Pliny, "*Ubi virus, ibi virtus.*"*—So that food, remedies, and poisons, may be said to branch into each other by indefinable gradations;—Five grains of *Camphor* act as a mild sedative and slight diaphoretic, but twenty grains induce nausea, and act as a stimulant; so again, *Opium*, in too large doses, instead of promoting, prevents sleep, and rather stimulates the bowels than acts as a narcotic. Two ounces of any neutral salt are apt to be emetic, one ounce even of *Alum* to be cathartic, and two drachms to be refrigerant; in like manner the preparations of *Antimony* either vomit, purge, or sweat, according to the quantity exhibited.

Would it not appear that *powerful doses rather produce a local than general effect*? Experience seems to prove in this respect, that the effect of an internal application is similar to that of an external impression; if violent, it affects the part only to which it is applied, as pinching does that of the skin, whereas titillation, which may be said to differ only from the former in degree, acts upon the whole system, and occasions itching and laughter, and if long continued, weakness, sickness, vomiting, and convulsions; in like manner *Digitalis*, if given in large doses, acts immediately upon the stomach or bowels, becoming emetic and cathartic, but in smaller proportions it produces a GENERAL effect, increasing all the excretions, especially that of urine; so, again, large doses of the *Mercurial Pill* act upon the bowels, and are eliminated from the body, whereas the same remedy in small doses affects the system generally, and excites a universal influence. I am well satisfied that the regulation of the dose of a medicine is even more important than it is usually supposed to be. *Substances perfectly inert and useless in one dose, may prove in another active and valuable.* Hence may be explained the great efficacy of many mineral waters, whilst the ingredients which impart activity to them are found comparatively inert, when they become the elements of an artificial combination; and hence probably the failure of many *alterative* medicines, when no other rational cause can be assigned for it. We need not seek far for an example of the very different and opposite effects which the same substance can produce in different doses; the operation of *Common Salt* is familiar to us all; Sir John Pringle has shown that in quantities such as we usually take with our food, its action is highly septic, softening and resolving all meat to which it is applied, whereas in larger quantities it actually preserves such substances from putrefaction, and therefore, when so taken, instead of promoting, destroys digestion.

* The word "*Venenum*," was employed by the ancients to signify both a *poison* and a *medicine*; in the former of these acceptations it is used by Virgil in the following passage.

"Picus equum domitor, quem capta cupidine conjunx
Aurea percussum virga, versumque VENENIS,
Fecit avem Circe, sparsitque coloribus alas."
Æneid. Lib. vii.

In the latter sense it is used by Plautus—

"Quia sorbitione faciam ego te hodie mea
Item, ut Medea Peliam concoxit senem,
Quem medicamentis, et suis VENENIS dicitur
Fecisse rursus ex sene adolescentulum
Item ego te faciam."

It is moreover probable that medicinal, like nutritive substances, are more readily absorbed into the circulating system when presented in small quantities, than when applied in more considerable proportions. It is upon this principle that a large quantity of food, taken seldom, does not fatten so much as smaller quantities at shorter intervals, as is exemplified in the universal good condition of cooks and their attendants. It is not pressing the principle of analogy too far to suppose that the action of *alteratives*, which require to be absorbed, may be more effectually answered by similar management; that is, *by exhibiting small doses at short intervals*.

The operation of medicines is influenced by certain general circumstances, which should be also kept in mind when we apportion their dose; e. g. Age—Sex—Temperament—Strength of the Patient—Habit—Diet—Profession—Climate—Duration of the Disease—State of the Stomach—Idiosyncrasy—and The Variable Activity of the Medicinal Substance.

Women generally require smaller doses than men. Habit, or the protracted use of a medicine, generally diminishes its power, although certain cathartics appear to offer an exception, for when long continued, their activity is proportionally increased, as is well known to every person who is familiar with the operation of the Cheltenham waters. Dr. Lamb has also stated with regard to the operation of Lead, "that the constitution so far from being reconciled to it by habit, is rendered more and more sensible to its irritation by continuance. Emetics also frequently become more powerful by repetition; Cullen informs us that he knew a person so accustomed to excite vomiting in himself that the one twentieth part of a grain of tartarized antimony was sufficient to excite a convulsive action of the stomach; in some cases such an effect may perhaps be referred to the operation of the mind; for after the frequent use of an emetic, the mere sight of it, or even conversation relative to it, has been found sufficient to excite nausea.

In apportioning the dose of a very active medicine, it is of the greatest moment to determine the relative degrees of power between the system and the remedy, and to know to what extent the latter is likely to be carried, consonantly with the powers of life to resist it; thus, after a patient has been exhausted by protracted and severe suffering and watching, a dose, different to one at the commencement of the disease is requisite. The importance of this precept is impressed upon my mind from having witnessed, in the course of my practice, several instances of the mischief which has arisen from a want of attention to it; that disease materially influences the condition of the body, and its susceptibility to remedial impressions, has been already demonstrated. Emetics act very readily in febrile affections, while in those of the Neuroses* they produce their effects with difficulty.

In the application of external remedies to diseased parts, it especially behooves the Surgeon to take into consideration the degree of vitality possessed by such parts, and to graduate their strength accordingly.

Mr. Henry Earle† has published a very interesting case in illustration

* See the dissertation on the operation of *Emetics*, page 86.

† Cases and Observations, illustrating the influence of the Nervous System, in regulating animal heat, by H. Earle, Esq.; published in the 7th volume of the Medico-Chirurgical Transactions.

of this principle. The arm of a person became paralytic, in consequence of an injury of the axillary plexus of nerves from a fracture of the collar bone; upon keeping the limb for nearly half an hour in a tub of warm grains, "*which were previously ascertained by the other hand not to be too hot*," the whole hand became blistered in a most alarming manner, and sloughs formed at the extremities of the fingers, and underneath the nails; a considerable degree of inflammation subsequently spread in the course of the absorbents, and matter formed in the axilla, which was soon absorbed, and the inflammation assuaged. Whence it follows, that a limb deprived of its usual supply of nervous energy cannot sustain, without injury, an elevation of temperature which would not be in the least prejudicial to a healthy member. Mr. Earle supports this conclusion by the relation of another case, in which the ulnar nerve had been divided, for the cure of a painful affection of the arm; the consequence of which operation was, that the patient was incapable of washing in water at a temperature that was quite harmless to every duly vitalized part, without suffering from vesication and sloughs.

Before we quit the subject of Dose, it may be necessary to observe, that there are many remedies that do not act with greater violence in a large dose than in one comparatively small; *Ipecacuan*, for instance, is more certain in its operation, but not more violent, when given in a large quantity; the same may be said of *Aloes*, and several other medicines.

The Variable Activity of a Medicine should also be appreciated, and perhaps the practitioner would act cautiously if he were to reduce the dose, should it be a very considerable one, whenever a fresh parcel of the medicine is commenced, especially of the powder sof active vegetables liable to deterioration from being kept, as those of *Digitalis*, &c.

The Time of the Day at which remedies should be administered deserves likewise some attention. *Evacuating Medicines* ought to be exhibited late at night or early in the morning. It would seem that during sleep the bowels are not so irritable, and consequently not so easily acted upon, which allows time for the full solution of the substance; the same observation applies to *Alterative* and other medicines which are liable to suffer from a vexatious irritability of the bowels; it is on this account eligible to exhibit *Guaiacum*, *Pilulæ Hydrargyri*, &c., when they are not intended to purge, at bed time. On the other hand, where the effects of a remedy are likely to be lost by perspiration, as is the case with *Diuretics*, many of which are by external heat changed into *Diaphoretics*, it may become a question with the judicious practitioner whether he cannot select some more favourable period for their exhibition.

In fevers it is of importance to consult in all respects the quiet and comfort of the patient; Dr. Hamilton therefore, in his valuable work on Purgatives, very judiciously observes that, on this account, the exhibition of purgative medicines should be so timed, that their effects may be expected during the day.

In some cases the time of administering a remedy must be regulated by the stage of the disease; thus, in fevers, a dose of opium will either increase the heat of the body, augment thirst and restlessness, or occasion tranquillity and sleep, according to the temperature of the body at the time of its administration; for this reason Dr. Currie advises us not

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to give the evening dose of Opium in Typhoid fevers, till very late, or about one or two o'clock in the morning, when the heat is subsiding, and moisture is coming on. Emetics administered for the cure of the slighter cases of Pyrexia should be given in the evening, as their operation leaves a tendency to sleep and diaphoresis, which it is useful to promote. Remedies that require to be *absorbed* will probably be more efficient in the morning after sleep; the old custom of giving medicines on a morning *fasting*, is not quite so absurd as some modern practitioners have been led to suppose. Diaphoretics should be always given after the digestive process is ended, for during the performance of this function the emunctories of the skin are less disposed to action.

The Intervals between each Dose must be regulated by the nature of the remedy and that of the objects which it is intended to fulfil, and whether it be desirable or not that the latter dose should support the effects of the preceding one, or whether there be any fear of a reaction or collapse taking place after the effect of one dose has subsided, unless immediately repeated; thus the effects of diffusible stimulants, such as ammonia and æther, are very evanescent, they should therefore be repeated at short intervals; the same may be said of *Diaphoretics*, especially the lenient ones; we ought not to allow the period between the doses to be so remote as to occasion any striking abatement in the impression: so Opium, where its primary and stimulant operation is required, as in diseases of debility, such as fevers of the typhoid type, should be given in small doses at short intervals, so that it may enkindle and sustain a uniform and regular state of excitement: but where the object is to mitigate pain, allay irritation, and produce sleep, it ought to be exhibited in full doses, at distant intervals. There is a caution also which it is very necessary to impress upon the practitioner, respecting the power which some medicines possess of *accumulating** in the system; this is notorious with regard to Lead and Mercury, and probably with the preparations of Arsenic, and some other metallic compounds. Dr. Withering has observed that the repetition of small doses of *Digitalis*, at short intervals, till it produces a sensible effect, is an unsafe practice, since a dangerous accumulation will frequently take place before any signals of forbearance present themselves. I have already alluded to the possibility of mercurial accumulation, and its developement at a remote period.

Constitutional Peculiarities, or Idiosyncrasies, will sometimes render the operation of the mildest medicine poisonous, "*Virum novi*," says Gaubius, "*qui cum fatuum lapidum cancrorum pulvisculum ingessit, vix mitius afficitur quam alii ab Arsenico.*" I have seen a general Erysipelas follow the application of a blister, and tormina of the bowels, no less severe than those produced by the ingestion of *Arsenic*, attend the operation of purgatives composed of *Senna!* In some constitutions Antimony has been known to produce a ptyalism; Dr. James assured

* By the use of this word I wish to be distinctly understood as expressing only certain *effects*, without any regard to the causes that may produce them. The phenomena of *Accumulation* may on some occasions depend upon the absolutely increased quantity of the substance in the body, as in the instance of mercurial action, while in others they may perhaps arise from the system becoming more and more sensible to its stimulus. The history of poisons would afford some interesting illustrations of these views, and in another work (Medical Jurisprudence, Vol. 2, p. 148,) I have proposed a new subdivision of these bodies, under the title of "*Accumulative* Poisons."

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Sir George Baker that he knew six instances of it, although the patients thus affected had neither their teeth loosened, nor their breath made offensive. The peculiar susceptibility of certain individuals to the effects of particular plants is also very singular; Murray relates that unpleasant symptoms have been experienced by merely keeping *Aconite* for some time in the hand, or on the bosom. I am acquainted with two persons in whom the odour of Ipecacuan always produces a most distressing dyspnæa; Mr. Chevalier informs us, that he once knew a lady who could not take *Powdered* Rhubarb, without an erysipelatous efflorence almost immediately showing itself on the skin, and yet she could take it in the form of *Infusion* with perfect impunity. There are some idiosyncrasies so singular and incredible, that nothing but unimpeachable testimony could sanction our belief in their existence. Schenkius relates a case in which the general law of astringents and cathartics was always reversed. Donatus tells us of a boy whose jaws swelled, whose face broke out in spots, and whose lips frothed, whenever he eat an egg.

The late Pope Pius VII. had such an antipathy to musk, that on one occasion of presentation, an individual of the company having been scented with that perfume, his holiness was obliged to dismiss the party almost immediately.* Education, and early habits certainly establish very extraordinary peculiarities in different countries with respect to various objects of diet and luxury; what shall we say of the refinement of the ancients who regarded the flavour of the Citron with disgust, while the odour of putrid fish was deemed by them so exquisite, that they carried it about in caskets of onyx as a favourite perfume! Custom makes the Greenlander relish his train oil; and Dr. Heberden tells us, that there is a town in North America, where the spring-water is brackish, and that, when the inhabitants visit any other province, they choose to put salt into their tea or punch, in order, as they say, "*to make it taste as it should do.*"†

Climate. Several observations have already been offered upon the influence of Climate in affecting the activity of our remedies.‡ With regard to its relations to *Dose*, I have only one remark to make to the English practitioner, and that by the way of caution, that he will not allow his own previous experience in hot climates, or the persuasions of other tropical practitioners, to induce him to administer such doses of Mercury, in England, as may have been found salutary in India, or in other Colonies of similar temperature.

The popular scheme of Gaubius for graduating the doses of medicine to different ages which was published in several of the former editions of this work, is now omitted, as being less easy of application, than the following simple formula by Dr. Young.

* "Diary of an Invalid."
† Med. Transact. Vol. 1, p. 5.
‡ See Historical Introduction.

RULE.

For children under twelve years, the doses of most Medicines must be diminished in the proportion of the Age, to the Age increased by 12.

thus at two years to $\frac{1}{7}$—viz.

$$\frac{2}{2+12} = \frac{1}{7}$$

At 21 the full dose may be given.

Every general rule however respecting the doses of medicines will have exceptions. Thus children will bear larger doses of *Calomel* than even adults, and many medicines which do not affect adults, although exhibited in considerable quantities, prove injurious even in small doses to children.*

In concluding this part of the subject, it is proper to impress upon the practitioner the importance of writing his prescriptions in legible characters, and of avoiding all those abbreviations which are not generally understood, or which are capable of misconstruction.†

ON THE PARTICULAR FORMS OF REMEDIES, AND THE GENERAL PRINCIPLES UPON WHICH THEIR CONSTRUCTION AND ADMINISTRATION ARE TO BE REGULATED.

SOLID FORMS.

PULVERES. *Powders.*

The form of powder is in many cases the most efficient and eligible mode in which a medicinal substance can be exhibited, more especially under the following circumstances.

1. *Simple Powders.*

1. Whenever a remedy requires the combination of all, or most of its principles, to ensure its full effects, as *Bark, Ipecacuan, Jalap, &c.*
2. Where medicinal bodies are insoluble, and indisposed to undergo

* The Mechanical Physicians attempted to adjust the doses of medicines according to the constitution, by a mathematical rule; thus they say, "the doses are as the squares of the Constitution." And in the Edinburgh Medical Essays, there is actually a formal attempt to correct the errors of this rule. See "An Essay towards ascertaining the doses of vomiting and purging Medicines, by Dr. CHARLES BALGUY, Physician at Peterborough." Vol. 1. 167.

† While this sheet was passing through the press, an anecdote was related to me, which is well calculated to illustrate the mischief that may arise from abbreviated prescriptions. One of our most eminent surgeons having occasion to direct the application of a Lead Plaster (Emplast: Lythargyi P. L. 1787,) he abbreviated the term as follows—*Emp. Lyth*: in the haste of compounding, the *h*, perhaps carelessly written, was easily mistaken for *t*, and the chymist accordingly sent the *Emplast: Lyttæ!* As it was applied to the Pudenda, it is not necessary to state the distress of the patient, and the dismissal of the practitioner, which followed.

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those essential changes, *in transitu*, which render them operative; for it must be remembered that by minute division, every particle is presented to the stomach in a state of activity, being more immediately exposed to the solvent or decomposing powers of that organ.

3. Where the mechanical condition of the substance is such as to occasion irritation* of the stomach, as the *Sulphuretum Antimonii*, or in external applications to produce an improper effect upon the skin, as *Hydrargyri nitrico-oxydum*.

The degree of fineness to which substances should be reduced by pulverization, in order to obtain their utmost efficacy, is a very important question. The impalpable form appears to be extremely injurious to some bodies, as to *cinchona*, *rhubarb*, *guaiacum*, and to certain aromatics, in consequence, probably, of an essential part of their substance being dissipated, or chymically changed by the operation. Fabbroni, for instance, found by experiment that cinchona yielded a much larger proportion of soluble extractive, when only coarsely powdered. I think it may be laid down as a general rule, that *extreme pulverization assists the operation of all substances whose active principles are not easily soluble, and of compound powders whose ingredients require, for their activity, an intermixture; whilst it certainly injures, if it does not destroy, the virtues of such as contain as their active constituent, a volatile principle which is easily dissipated, or extractive matter which is readily oxidized.*

2. *Compound Powders.*

The disintegration of a substance is much accelerated and extended by the addition of other materials; hence the pharmaceutical aphorism of Gaubius, "*Celerior atque facilior succedat composita, quam simplex pulverisatio.*" Thus several refractory vegetable bodies, as *myrrh*, *gamboge*, &c. are easily reduced by triturating them with sugar or a hard gum; and some gum resins, as *assafœtida* or *scammony*, by the addition of a few drops of almond oil. Upon the same principle the Pharmacopœia directs the trituration of aloes with clean white sand, in the process for preparing *Vinum Aloes*, to facilitate the pulverization and to prevent the particles of aloes, when moistened by the liquid, from running together into masses; some dispensers very judiciously adopt the same mechanical expedient in making a tincture of myrrh; so again, in ordering a watery infusion of opium, it will be judicious to advise the previous trituration of the opium with some hard and insoluble substance, as directed in the *Pulvis Cornu Usti cum Opio*, otherwise its particles will adhere with tenacity, and the water be accordingly unable to exert a solvent operation upon its substance.† It is equally evident that in the

* Camphor, unless it be presented to the stomach in a state of minute division, is liable to occasion heat and uneasiness in that organ. Fothergill's Med. Observ. vol. i. p. 432.

† In some cases the subject to be pulverized has been previously exposed to heat, but the doubtful influence of exalted temperature upon vegetable bodies, ought to afford us a lesson of extreme caution; the astringency of the stalks of the Artichoke is entirely destroyed by being gently heated in an oven, for after this operation they no longer strike a black colour with the salts of iron; another example is afforded us in the effects of heat upon Starch, which is thus changed into a species of gum, no longer producing a blue colour with Iodine, and which is known in commerce under the name of "British Gum."

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construction of compound medicinal powders, the addition of an inert ingredient, which the mere chymist might condemn and discard as useless, not unfrequently acts a very important part in the combination, owing to its effects in dividing and comminuting the mere active constituents: *the sulphate of potass* in Dover's powder acts merely in dividing and mixing more intimately the particles of opium and ipecacuan: the *phosphate of lime* appears to act in the same mechanical manner in the Antimonial Powder; so again, in the *Pulvis Contrajervæ compositus*, the prepared oyster shells may be a necessary ingredient: in the *Pulvis Jalapæ compositus* of the Edinburgh College, the cream of tartar greatly increases the activity of the jalap, by breaking down its substance and dividing its particles; and Van Swieten observes that the operation of this resinous purgative is improved by bruising it with sugar, and adding some aromatic. The old combination of *Pulvis Helvetii* consisted of alum and dragon's blood, and there can be no doubt but that the effect of this latter ingredient, which has been often ridiculed, was to retard the solution of alum in the stomach, in consequence of which the preparation was likely to produce less inconvenience, and could therefore be administered in larger doses; the Edinburgh college has substituted gum Kino in their *Pulvis Aluminis compositus*, which may have the same effect in modifying the solubility of the alum.

In rubbing together different substances, it is necessary to remember that there are many saline bodies, which in the dry state become moist and even liquid, by triture with each other, and that, under such circumstances, they are susceptible of mutual decomposition. This change is effected by the action of water, derived from the following sources.

1. *From the water of crystallization.* This always operates when the proportion contained in the original ingredients is greater than that which the products can dispose of; that is to say, whenever the capacity of the new compound for water is less than that of the original ingredients. By previously driving off this water by heat, we shall of course avoid such a source of solution, and no liquefaction can ensue. Thus, if recently burnt quicklime be triturated with calomel, the resulting mixture will be white, showing that no decomposition can have arisen, but add a few drops of water, and it instantly assumes a dark aspect. If *crystallized* sulphate of copper be triturated with Acetate of lead, the resulting mixture will assume a fine green colour, but if the sulphate of copper be previously heated, and its water of crystallization driven off, no change of colour will be produced: if, for Acetate of lead, we substitute muriate of lime, and the sulphate of copper be *crystallized*, we shall obtain a result of a yellow colour, but if the sulphate of copper be *anhydrous*, the product will be colourless, becoming however instantly yellow, like the former, on the addition of a drop of water; and on a further addition of this fluid, the yellow product in both instances will be rendered blue; which proves that a chymical decomposition has taken place, and a muriate of copper resulted; for this salt is rendered *yellow* by a small, and *blue* by a larger proportion of water. The *Cuprum Ammoniatum* presents another illustration, for the ingredients, when rubbed together, become extremely moist, and undergo a chymical decomposition. Certain resinous bodies also, as *myrrh*, become liquid by triture with alkaline salts, in which case the resin and alkali from a soluble compound, which the water of crystallization, thus set at liberty, instantly dissolves.

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2. *From aqueous vapour in the atmosphere.* The water of the atmosphere does not act upon these occasions, unless it be first attracted and absorbed by one of the triturated bodies; e. g. if Acetate of lead and recently burnt alum be triturated together, no change will be produced; but, if the burnt alum be previously exposed for a short time to the atmosphere, these bodies will, in that case, become liquid.

The Physician without this chymical knowledge, will be often betrayed into the most ridiculous blunders, an instance of which very lately came to my knowledge in a prescription for the relief of cardialgia and constipation, in the case of dyspepsia; it directed *sulphate of soda* and *carbonate of potass*, in the form of a powder, but the *fiat* of the physician, upon this occasion, only served to excite the ridicule of the dispenser, who soon discovered that the ingredients in his mortar dissolved into liquid.

During the exhibition of powders containing insoluble matter, it is always important to maintain a regularity in the alvine excretions, or an accumulation may take place attended with very distressing symptoms. Dr. Forthergill relates a case of this kind which succeeded the use of powdered bark; and Mr. E. Brande has communicated a similar instance of mechanical obstruction, produced by the habitual use of magnesia. I could also add, if it were necessary, some striking facts of a similar tendency, which occurred from eating bread that had been adulterated with pulverized *felspar*. The precaution seems more particularly necessary in the case of children, whose bowels are very impatient of extraneous and insoluble contents.* The dose of a powder ought not to exceed 3j; and, when taken, should be diffused in water, wine, or any other convenient liquid; resinous and metallic powders require a thick and consistent vehicle, as syrup or honey, since they subside from those which are more fluid.

PILULÆ. *Pills.*

These are masses of a consistence sufficient to preserve the globular form, and yet not so hard as to be of too difficult solution in the stomach. The subject offers some extremely interesting points of inquiry. The following general rules will enable the practitioner to select those substances to which the form of pill is adapted, and to reject those to which it is not suitable, as well as to direct, *extemporaneously*, the most efficient mode of preparation.

I. The Selection of Substances.

1. *Suitable Substences* are, 1. All remedies which operate in small doses, as *Metallic Salts;* and 2. Those which are designed to act slowly

* It is perhaps not generally known, that the sugared plums sold to children consist very frequently of Plaster of Paris; the introduction of such a substance into the intestines may often prove a source of mischief. I also understand, that it is no uncommon fraud to adulterate biscuits with the same substance. I confess I felt a great inclination to oppose the practice, lately suggested, of improving bad flour by the addition of Magnesia; I object to the introduction of any foreign and insoluble substance into our daily bread, and I am satisfied that the result of medical experience will sanction such an objection.

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and gradually, as certain *Alterative Medicines*; or 3. which are too easily soluble when exhibited in other forms, as *Gamboge*, *&c.* 4. Substances which are not intended to act until they reach the larger intestines, as in pills for habitual costiveness; *see Aloes.* 5. Bodies whose specific gravities are too considerable to allow their suspension in aqueous vehicles. *Efflorescent* salts may also be exhibited in this form, but they ought to be first deprived of their water of crystallization, or the pills composed of them will crumble into powder as they dry.

2. *Unsuitable Substances* are, 1. Those which operate only in large doses. 2. Which deliquesce. 3. Whose consistence is such as to require a very large proportion of dry powders to afford them a suitable tenacity, as *oils*, *balsams*, *&c.* 4. Substances that are so extremely insoluble, that when exhibited in a solid form they pass through the canal unaltered, as certain *extracts.*

Many remedies which are incompatible with each other in solution, may be combined in pills, unless indeed their medicinal powers are adverse or inconsistent, or their divellent affinities sufficiently powerful to overcome their state of aggregation.

II. Their Formation into Masses.

This is a subject of far greater importance than is usually assigned to it, as will be more fully explained in the sequel.

1. Many substances, as *vegetable extracts*, may be formed into pills without any addition; others, as *gum resins*, become sufficiently soft by being beaten, or by the addition of a drop or two of spirit, or *liquor potassæ.* Some dry substances react upon each other, and produce, without the addition of any foreign matter, soft and appropriate masses. The *Pilulæ Ferri Compositæ*, of our Pharmacopœia afford a very striking example of this peculiar change of consistence, which the mutual reaction of the ingredients produces by simple triture. The *Pilulæ Aloes Compositæ* offer another instance; for the extract of gentian, upon being triturated with aloes, produces a very soft mass, so that the addition of a syrup, as directed by the Pharmacopœia, is quite unnecessary. See *Form.* 12.

2. Many substances are, in themselves, so untractable, that the addition of some matter foreign to the active ingredients, is absolutely essential for imparting convenience of form. It is generally considered that very little skill and judgment is required in the selection of such a substance, provided it can fulfil the *mechanical* intention just alluded to—the fact however is, that *the medicinal power of the pill may be materially controlled, modified, or even subverted, by the mode in which it is formed into a mass.* Where the active element of a pill is likely to be improved by minute division, a gummy or resinous constituent may be usefully selected: under the history of Aloes, I have alluded to a popular pill, known by the name of the *dinner-pill*, in which case the *mastiche* divides the particles of the aloes, and modifies the solubility of the mass. The *Pilulæ Opii* of the former Pharmacopœia of London, consisted of equal proportions of opium and extract of liquorice, and the mass was so insoluble that its effects were extremely uncertain and precarious: in the pre-

sent edition, soap has been very judiciously substituted; but in certain cases where we wish to protract the influence of opium, or that of any other active body, so as not to obtain its full effects at once, we may very advantageously modify its solubility, by combining it with a gum resin or some substance which will have the effect of retarding its solution in the stomach. The *Pilula e Styrace* of the Dublin college, presents itself as an efficient example of this species of pharmaceutical address; see also *Form.* 10, 11, 12. I am well acquainted with many formulæ whose utility has been sanctioned by experience, and I have no hesitation in believing that their salutary mode of operation would receive a plausible explanation from this simple law of combination. Dr. Young has very justly stated in his Medical Literature,* that the *balsam of copaiba* envelopes metallic salts, so as to lessen their activity; he says that the sub-carbonate of iron, made into pills with copaiba, was given for some weeks without any apparent effect; and that a few hours after the same quantity had been given, with gum only, the fæces were perfectly black. I do not know a more striking and instructive proof of the influence of a glutinous or viscid constituent, in wrapping up a metallic salt, and defending the stomach from its action, than is presented in the case published by the medical attendant Mr. Marshall, in consequence of the attempt of Eliz. Fenning to poison the family of Mr. Turner, of Chancery-lane, by arsenic, which she providentially administered in a heavy yest dumpling. *Soap* is very frequently used for the formation of pill-masses, and it is an excellent constituent for substances likely to be injured by meeting with an acid in the *primæ viæ;* many resinous bodies may also be reduced to a proper consistence by soap, although in prescribing it, its levity should be attended to, or otherwise the pills will be too bulky; in general it will combine with an equal portion of any resinous powder, as *Rhubarb, Jalap, &c.;* it is of course ineligible where the substances are decomposed by alkalies, as *Tartarized Antimony;* this last precaution will also apply to *aromatic confection* as a vehicle, on account of the carbonate of lime contained in it. The *Conserve of Roses* has the advantage of retaining its consistency much longer than mucilage, but as it contains an uncombined acid, it is frequently inadmissible; it could not for instance be with propriety employed with the precipitated sulphuret of antimony. Pills made with mucilage, are apt to crumble when they are rolled out; this is the case with the *Pilulæ Hydrargyri sub-muriatis;* some extract therefore would be a more convenient constituent; in this particular case, however, the addition of a few drops of spirit would supersede the necessity of *any* constituent. Castor oil, in some cases, especially with some of the harder purgative extracts, will impart an eligible consistence.

Crumb of bread furnishes a convenient vehicle for those salts which are ponderous, active in very small doses, or which are liable to be decomposed by other vehicles; but an objection is attached even to this, for it is liable to become so dry and hard when kept, that pills made with it will frequently pass undissolved. Swediaur mentions this fact with reference to Plenck's mercurial pill, as well as to one of corrosive

* Edition 2. 1823.—I shall avail myself of the present opportunity to recommend this work to the perusal of every student who is ambitious to become acquainted with the Literature of his profession.

sublimate, and he proposes for this reason to substitute *starch*; the addition however of a small portion of sugar will prevent the bread from becoming thus indurated, and with such a precaution it may be very safely employed. For the purpose of forming active vegetable powders into pills, such as *Digitalis*, *Conium*, &c., I am informed by Mr. Hume of Long Acre, that in his experience *molasses* or *treacle* is the best constituent that can be selected, for it undergoes no decomposition by time, but maintains a proper consistency, and preserves the sensible qualities of the plant quite unimpared for many years. I have deposited in the cabinet of the College, specimens of such pills, of *hemlock* and *foxglove*, which retain the characteristic odour of these vegetables, notwithstanding they have been now made for several years. *Honey* has likewise the property of preserving vegetable substances; *seeds* may be kept in it for any length of time, some of which, on being taken out, washed, and planted, will even vegetate. It has also been used for the preservation of animal matter; the bodies of the Spartan kings, who fell at a distance in battle, were thus preserved, in order that they might be carried home.*

Water will on some occasions be found a convenient expedient; powdered *Rhubarb* or *Jalap* may be thus made into masses without any increase of bulk, but the pills will be apt, if kept, to become mouldy.

3. In the formation of pills the ingredients should be hastily rubbed together, whenever they are liable to be injured by long exposure to the air; thus in the formation of *Pilulæ Hydrargyri submuriatis compositæ*, the compound is rendered less active by too long continued triture. See *Pulveres*.

4. *In dividing pill-masses, it is usual to add to them, and envelope them in magnesia*; where calomel is present, I have satisfied myself by experiment that a *muriate of magnesia* is formed under such circumstances, and it is owing to this partial decomposition, that the surface of the pill exhibits a greenish hue; starch, powder of liquorice,† or orrice root, might perhaps, under such circumstances be more judiciously preferred. In Germany, the powder of *Lycopodium* is generally used. Formerly, the pill was covered with gold leaf, which protected it from the influence of the stomach, and frequently rendered it unavailing.

It has been observed that many of the pill-masses directed in our Pharmacopœias, are liable to become so hard‡ and dry by being kept, that they are unfit for that division for which they were originally intended; indeed Dr. Powel considers it doubtful whether the greater

* Dr. Davy informs me that the *Veddahs*, a savage race inhabiting the wilds of Ceylon, even in that hot climate, effectually preserve their venison in honey.

† There is one circumstance which sometimes renders the powder of liquorice objectionable upon such occasions; it is liable to irritate the fauces and occasion coughing; for this reason I always avoid its use in cases of pulmonary irritation.

‡ Some extracts become so hard, that in the state of pill they pass unchanged; this has occurred to me with the *extract of logwood*. Astringent vegetable matter, in combination with iron, is frequently characterized by a hardness that is not exceeded by ebony, and which is perfectly insoluble; the action of iron upon the petals of the red rose furnishes a very striking instance of this fact; if the petals be beaten in an iron mortar, for some hours, they ultimately become converted into a paste of an intensely black hue; which, when rolled into beads and dried, is susceptible of a most beautiful polish, still retaining the fragrance of the rose. I have seen a necklace of this description; indeed these beads form an article of extensive commerce with the Turks, and are imported into Europe, through Austria, under the name of *Rose beads* or *Rose Pearls*.

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number of articles had not better be kept in powder, and their application to the formation of pills left to extemporaneous direction; the necessity of this is farther apparent, when we learn that it is a common practice for the dispenser to soften these masses by the application of a hot spatula, or pestle, which sometimes carbonizes, and frequently decomposes them.

III. Their Form of Prescription.

In our extemporaneous directions, it is necessary to apportion with accuracy the quantity of active materials which we may wish each pill to contain, and since the proportion of the *constituent* can rarely be exactly defined, the equable division of the whole mass, into a given number of pills, will be safer than defining the weight of each pill.

A pill, the bulk of whose ingredient is vegetable matter, ought not to exceed five grains in weight, but where the substances which compose it are metallic and ponderous, it may without inconvenience weigh six or even eight grains.

TROCHISCI. *Troches*, or *Lozenges*.

As these are regarded as objects rather of confectionary than of pharmacy, the London and Dublin Colleges have not condescended to notice them; the Edinburgh Pharmacopœia, however, contains several formulæ for their preparation; and as the form of lozenge offers a very commodious and efficacious method of administering certain remedies, the theory of its operation deserves some notice in the present work. It is principally useful in cases where it is an object that the remedy should pass *gradually* into the stomach, in order to act as powerfully as possible upon the pharynx and top of the trachea, as in certain demulcents or astringents; for instance, *Nitre*, when intended to operate in relaxed or inflamed states of the tonsils, is best applied in this manner; so is *Sulphate of Zinc* in chronic coughs, attended with inordinate secretion. In order to retard as long as possible the solution of the lozenge in the mouth, it ought to be composed of *several* demulcent substances, such as farinaceous matter, sugar, gum, and isinglass; for such a mixture will be found to answer the purpose better than any *one* of these articles taken by itself; thus the farinaceous matter will prevent the sugar and the gum from being too soon dissolved; the viscidity of the sugar and gum will prevent the farinaceous matter from being swallowed so soon as it would otherwise be; and the isinglass will give a softness to the whole, and thus prevent any sharp points from stimulating the membrane.

SUPPOSITORIA. *Suppositories.*

This form of preparation is very ancient, and although it has of late years fallen into disuse, it affords an efficacious mode of administering many powerful remedies, and in some instances of producing effects

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which the same medicine would not command if given in any other form: besides which, it is found that after the stomach by long use has lost its susceptibility to the action of medicine, such a substance will operate with fresh and unabated force if applied to the rectum. There are two great indications which *Suppositories* are calculated to fulfil, *viz.*

1. *The alleviation of pain and irritation*, especially when it arises from diseases of the bladder, prostate gland, uterus, and other parts in the vicinity. Abortion may be thus frequently prevented. To fulfil these intentions, a mixture of opium with two parts of soap, will be found eligible. I can recommend such an application from a well grounded experience in its efficacy.

2. *The production of Catharsis.* In cases of Apoplexy, from the counter-irritation which these remedies are likely to occasion, much advantage may arise; and in the failure of more common measures, they may be applied with certain success in the cure of Ascarides; see *Formula* 146. Where a very efficient Suppository is required, one or two grains of *Elaterium* rubbed up with eight grains of hard soap, will present us with a combination of great utility.

ELECTUARIA. *Electuaries.*

This is an ancient form of prescription; for although the term "*Electarium*" is first used by Cælius Aurelianus, yet the ἐκλεικτον of Hippocrates, and the *Antidotus*, *Confectio*, *Mithridatum*, *Diascordium*, *Opiatum*, *Orvietanum*, *Philonium*, *Theriaca*, and *Requies* of other authors, were all Electuaries. They differ from *Conserves* in this, that the sugar in the latter preparations is in a greater proportion, and is intended to *preserve* the ingredients; whereas in the former, it is merely intended to impart convenience of form; see *Confectiones*. Electuaries are in general, *extemporaneous* preparations, composed of dry powders, formed into a proper consistence by the addition of syrup, honey, or mucilage; when however the latter substance is employed, the electuary very soon becomes dry and hard; and when common syrup is used, the compound is apt to candy, and in a day or two to grow too hard for use; this is owing to the crystallization of the sugar; Deyeux therefore states, that the syrup should be previously exposed to the heat of a stove so long as it forms any crystals, and that the residual liquor, which from the presence of some vegetable acid has no tendency to crystallize, may then be advantageously applied;—*Molasses* or Treacle may in some cases be employed, and from experiments which I have repeated with some care, I am enabled to state that the peculiar flavour of this liquid is entirely removed by a simple operation, which consists in diluting it with an equal weight of water, and then boiling it with about one eighth part of powdered charcoal for half an hour, when the liquor is to be strained, and reduced by gentle evaporation to a proper consistence;* and moreover it appears, that active vegetable powders retain their characteristic qualities when immersed in *treacle*, longer than in any other excipient.

* Clell's Annals, 1798. vol. 1.

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In selecting and prescribing this form of exhibition, the following general rules should be observed.

I. Those substances which are nauseous, deliquescent, which require to be given in large doses, or which are incapable of forming an intimate union with syrup, as *fixed oils*, *balsams*, *&c.*, should never be prescribed in the form of an electuary.

II. The quantity of syrup directed must be regulated by the nature and specific gravities of the substances which enter into their composition, viz.

1. *Dry Vegetable Powders* require twice their weight of syrup, or of honey.
2. *Gummy and Resinous Powders* require an equal weight.
3. *Hard Mineral Substances* should be formed into an electuary with some conserve, as they are too ponderous to remain suspended in syrup. It deserves also to be noticed, that in consequence of the readiness with which metallic preparations undergo change, it will be generally adviseable to keep the active ingredients in the form of powder, and to add them to the syrup only just before they are required; the Electuary of the French Pharmacopœia, which is commonly called "*Opiata Mesenterica*," will furnish a good example, "*quantumvis molle fuerit recens, progressu temporis, ob ferrum quod ipsi inest, mirè indurescit.*"

2. *Liquid Forms.*

MISTURÆ. *Mixtures.*

These preparations are generally *extemporaneous*, in which, different ingredients are mingled together in the liquid form, or, in which solid substances are diffused through liquid, by the medium of mucilage or syrup: for prescribing mixtures the following general rules may be laid down.

I. Substances which are capable of entering into chymical combination, or of decomposing each other, ought not to be mixed together, unless it be with a view of obtaining the new products as a remedy.

II. Transparency is not a necessary condition,* and hence insoluble powders may be advantageously introduced into mixtures, if the following precautions be observed.

1. They must be divisible and mechanically miscible in the liquid.

* A remedy may even owe its virtues to a precipitation, produced by admixture, as I have already stated.

2. They must not possess too great a specific gravity.

3. They must not render the liquid too mucilaginous or thick; *thus*, f℥j *should seldom contain more than* ℥ss *of a vegetable powder*, ℈ij *of an electuary, and conserve; or* grs. xv, *or* ℈j *of an extract.*

III. The taste, the smell, and the general aspect of the mixture should be rendered as pleasant as possible; *thus milk covers the taste of bark, of the tinctures of guaiacum and valerian, and that of lime water; and a light decoction of the liquorice root disguises a bitter taste more effectually than sugar.*

The Physician may also produce occasional changes in the appearance of his mixture, in order to reconcile a delicate taste to its continuance; he never ought however to alter the essential part of plans which he finds advantageous.

A Draught differs merely from a mixture in quantity; it is usually taken at once, and should not exceed f℥iss; it should be always preferred when,

1. *The remedy is to be taken in a precise dose.*

2. *Whenever it is liable to spontaneous decomposition.*

3. *Whenever the action of the atmosphere occasions change.*

In apportioning the dose of mixtures, the following proportions are admissible, although not perfectly accurate. A Table Spoon full (*Cochleare Amplum*) f℥ss. Dessert Spoon (*Cochleare Mediocre*) more than f℥ij. Tea Spoon (*Cochleare Minimum*) f℥j. A Wine Glass (*Cyathus*) although very variable, may be estimated as containing f℥iss. The custom of measuring the dose of a liquid by dropping it from the mouth of phial is very erroneous;* it will therefore be proper to dilute an active medicine that is to be so apportioned, with at least a triple quantity of water, that its real dose may not be essentially altered by any slight variation in the quantity.

The temperature at which a liquid medicine should be given may perhaps merit a few observations. In general, the ordinary degree of heat is that which will best answer the intention, but in cases of dyspepsia, the sense of weight and uneasiness, which often follows a dose of medicine, will be prevented by giving it in a tepid state. This remark will apply to the administration of the *Decoction of Sarsaparilla;* Refrigerants should of course be given as cool as possible; Chamomile Infusion, and other vegetable Ptisants, which are designed to promote the operation of an emetic, will be more efficient when warm. In delicate chlorotic females I have sometimes found chalybeate draughts not only more efficacious, but less distressing to the stomach, when exhibited in a tepid state.

* See my work on Medical Chymistry, Sect. Cohesion

ENEMATA. *Clysters.**

"*Lavamenta.*"

This form of applying a medicine furnishes the practitioner with many valuable resources, although the remedy has not escaped its due share of persecution. Paracelsus bestowed upon it the epithet "*turpissimum medicamentum*," and Van Helmont that of "*pudendum medicorum subsidium.*"

It is calculated to fulfil the following indications, viz.

1. *To promote the tardy operation of a Cathartic, or to evacuate the bowels, where from delicacy of stomach, medicines cannot be retained, or from debility of body they cannot be safely administered.*

In the administration of a remedy of this kind, there are two essential circumstances, independent of the *strength* of its ingredients, which will modify its activity, viz. IMPULSE and QUANTITY, by which we obtain the stimulus of distention; warm water without any adjunct may thus be made the means of overcoming those unrelenting obstructions, which had refused obedience to more common measures: Clysters, however, when most forcibly urged, rarely reach beyond the sigmoid flexure of the colon, and yet when the largest quantity of fluid which the bowels will admit is introduced with considerable impulse, the local impression is so powerful that it is at once extended by the medium of sympathy, through the whole of the alimentary canal, and very thorough and copious discharges result.

2. *To induce extreme relaxation:*

Which is best effected by an infusion of Tobacco. See *Tabaci Folia.*

3. *To produce Astringent and Anodyne, or Carminative effects.*

Common starch, with the addition of Tincture of Opium, is the most common and convenient form for this purpose. See also *Assafœdita*, *Terebinthinæ Oleum*, and *Formulæ* 8, 9, 29, 30. In some cases the injection of *cold water* acts as a powerful astringent, and from its impression upon the rectum, will frequently afford instantaneous relief in the piles.

4. *To destroy Ascarides.* See *Form.* 164.

5. *To act as an emollient fomentation.*

6. *To convey nutriment.*

In the administration of Clysters, for the fulfilment of any of the last five indications, it is obvious, that the stimulus of distention should be avoided, as being incompatible with our object; the quantity, or bulk of the solution, ought to be also carefully graduated; to prevent, for exam-

* Clyster from κλύζω eluo, to wash out.

ple, the opiate clyster from being too soon returned, Dr. Cullen has remarked that it seldom should be made of more bulk than that of three or four ounces of liquid, and this also of a very mild kind. In administering a bitter decoction for the cure of Ascarides, the same precaution is necessary, or the gut will suddenly contract and expel the clyster, which always acts with more certainty when allowed to remain for some time. The proportions of fluid vehicle necessary for the different stages of life, under ordinary circumstances, may be stated as follows:—An infant at its birth, or soon after, requires about one *fluid ounce;* a child between the age of one and five years, from three to four *fluid ounces;* a youth of ten or fifteen, from six to eight *fluid ounces;* and an adult may take twelve. With regard to the dose of the active ingredient of a ***Lavement***, it may be estimated as triple of that taken by the mouth.

INJECTIONES.

Under this head may be comprehended the various medicinal preparations which are employed as local applications;—to the urethra for the cure of gonorrhæa, and to the vagina for that of the different discharges to which females are liable.

With respect to the former of these it has been truly observed, that "among the whole class of remedies employed for surgical purposes, there is scarcely one which has occasioned a greater diversity of opinion;" to enter however into an examination of this subject would be entirely foreign to the intention of the present work; it is only necessary to state, that for their preparation the same principles of combination, and the same chymical precautions, apply, as have been already investigated under the head *Misturæ*. In some cases the practitioner will find it useful to ensure the entire solution of his active ingredient; while in others, the presence of a precipitate may enhance the efficacy of the application, as illustrated by *Form.* 62.

In the preparation of injections for the cure of female discharges, it must be remembered that, if they be of a vegetable nature, their efficacy wholly depends upon the *Tannin* which they contain, and the prescriber must therefore take care not to invalidate the force of this principle by any incompatible additions.

And it deserves to be remembered, that as *Tannin* has the power of coagulating animal mucus, and of forming with it an insoluble precipitate, its administration, as an injection, is liable to occasion the evacuation of whitish or ash-coloured flakes, which will come away from time to time, and excite in the patient's mind, says Mr. Clarke, the apprehension that she is voiding portions of the internal parts of the body, unless her mind be prepared for the occurrence by a previous explanation, and which the judicious practitioner will not neglect to afford. In some cases it will be necessary to correct the irritating effect of the astringent by the addition of a demulcent, as exemplified in *Form.* 61. In applying this form of remedy an ivory syringe should be always preferred to one of pewter, whenever the solution is likely to be affected by the contact of a metal.

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INHALATIONES. *Inhalations.*

Under this general title may be comprehended two distinct classes of volatilized substances, *viz.*

Dry Fumes, (*Suffitus,*) and Watery Vapours (*Halitus.*)

Before we enter upon the consideration of this particular form of remedy, it may be necessary to state, generally, that it appears to be capable of affording a very expeditious and powerful mode of affecting the body by certain medicines. If the power of a remedy be so greatly modified by circumstances affecting its solubility, as we have already proved, it cannot be a matter of surprise that the still farther diminution of its cohesion should occasion a corresponding influence upon its energies; indeed it would appear that some few substances are entirely inert, when applied under any other form, see *Hydrargyrum*, in an after part of this work. We are, moreover, enabled by these means, to bring various bodies into immediate contact with organs, which are inaccessible to such remedies in every other state of aggregation. This observation applies more particularly to the lungs, and the subject has lately occupied the attention of a worthy and skilful physician, whose work* is well entitled to the serious consideration of the profession.

The practice of causing patients to inhale various volatilized substances appears to have been of very ancient date. It has been already stated in this work (p. 39) that the fumes of Orpiment were directed to be breathed by Galen, and that the practice has been adopted by practitioners of later date.† Few attempts of this kind however were made, until the time of our countryman Bennet, the author of "*Theatrum Tabidorum*," who arranges volatilized substances into the two classes which have been announced at the head of the present section, *viz. Suffitus*, and *Halitus*. The numerous trials which have been since made with the different gases must be in the remembrance of every reader, but unfortunately, the injudicious and empirical spirit with which these inquiries have hitherto been conducted, has thrown such discredit upon the subject, that the practitioner who should resume the investigation, must be prepared to hear his understanding, or his integrity, questioned.

Suffitus. *Fumes of Burning Substances.* The particular forms of pulmonary disease in which Tar fumes appear to be most serviceable, are of the chronic kind; where an inflammatory diathesis prevails, or any tendency to hæmopthysis exists, the practice cannot be said to be free from danger. In the treatment of hooping-cough the inhalation of tar fumes have been also said to be beneficial. For the mode of applying this remedy, see *Pix Liquida.*

The practice of smoking the roots of *Stramonium*, *Tabacco*, &c., might with propriety be noticed under this head. With respect to

* Practical Observations on the Treatment and Cure of several Varieties of Pulmonary Consumption; and on the Effects of the Vapour of Boiling Tar in that Disease. By Sir A. Crichton, M. D. F. R. S., &c. London, 1823.

† Pliny (Nat. Hist. Lib. xxiii cap. 6) has the following interesting allusion to the subject of Tar fumes, "Silvas eas duntaxat quæ picis resinæque gratia raduntur, utilissimus esse phthisicis aut qui longa ægritudine non recolligent vires, satis constat; et illum cæli aëra plus ita quam navigationum Egyptiani proficere, plus quam lactes herbedos per montium æstiva potus."

the former of these remedies, much has been said and written, and asthmatic patients have occasionally expressed a belief in its palliative powers; in my own practice, however, I have never met with any success that has inspired my confidence. See *Stramonii Herba.*

Halitus. *Aqueous Vapours.* In certain catarrhal affections, when accompanied with painful and difficult expectoration, benefit may be occasionally obtained from the inhalation of the steam of hot water, or of vinegar and water, the acid in this case assisting the expectoration, while the whole acts as an emollient and soothing application to the tender and inflamed vessels of the internal surface of the bronchial tubes. The same practice is also highly serviceable in Cynanche Trachealis, and Tonsillaris.

In Pneumonia, after the violence of the arterial excitement has been reduced by depletory measures, the inhalation of the steam of hot water, or decoctions of emollient herbs, will often contribute to the support of an easy expectoration.

It has been already stated under the history of Expectorants (*page* 109,) that in certain dry states of the air, the evaporation of water in an artificially warmed apartment, is frequently attended with considerable relief to the pulmonary patient.

In Dyspnæa, attended with a spasmodic condition of the pulmonary organs, vapours impregnated with sulphuric æther have been recommended for inhalation. Dr. Pearson also states that the efficacy of such an application is materially enhanced by dissolving in it a portion of the extract of Conium. Dr. Böotcher of Copenhagen, has lately announced the utility of vapours of camphor, in complaints affecting the cavities of the nose, throat, and chest. He states that in the worst case of stoppage of the nose from catarrh, a piece of camphor need only be kept for a few minutes before it, to obtain great relief; the same application has been known to produce good in Cynanche Tonsillaris.

In order to apply such inhalations we may employ the inhaler invented by Dr. Mudge, or if that instrument be not at hand, the spout of a tea pot, or a common basin with an inverted funnel, will be found very convenient substitutes.

REMEDIES OF EXTERNAL APPLICATION.

This class of medicinal agents formerly comprised a much wider range of forms than it at present contains; such as numerous *Epithems; Vapours; Aromatic Bags; Medicated Quilts, &c.*

The external remedies of the present day may be divided into two orders, viz.

1. Those whose effects are entirely *local*, as exemplified in the application of certain *refrigerating* embrocations, *stimulating* cataplasms, and *astringent* unguents.

2. Those which excite general effects, or produce an influence upon parts remote from those to which the remedy is more immediately addressed, as illustrated by the operation of mercurial liniments and unguents, or by the general tonic effects of adhesive plasters.

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With respect to the former of these divisions it is unnecessary to multiply our remarks; the objects which they embrace belong more particularly to the department of surgery, and from the investigation of the different modes and forms of external application we shall hereafter derive very ample and instructive illustrations. In considering the objects of the latter division, a very interesting and important question immediately suggests itself for our consideration—How far a medicinal substance, when locally applied to the surface of the body, may be capable of affecting the general system, or some of its more remote parts?—the experienced practitioner will feel no hesitation in admitting numerous proofs of the existence of such agency; and it would seem probable that topical applications may produce general effects by several distinct modes of operation, viz.

1. *By exciting an impression on the nervous system.*
2. *By modifying the cuticular discharge.*
3. *By being absorbed into the circulation.*

In considering the different forms of external applications, it will appear that, for their extemporaneous construction, preparation, and application, the same scientific knowledge, practical skill, and pathological acumen will be required, as we have already stated to be so indespensably requisite to enable the physician to prescribe, and the pharmaceutist to prepare the various remedies intended for internal administration; although in regard to the former, it may be stated generally that the prescriber will more frequently be called upon to exercise that species of knowledge and address which enables the practitioner to impart a convenient and efficient *consistency* to his remedy; for an external application is far more dependent upon this circumstance for its efficacy, than one intended for internal use.

LOTIONES:

Remedies of a liquid nature, designed for external application.

Under this generic term, which strictly signifies a *wash*, may be comprehended several species of medicines, calculated for the fulfilment of different indications, as Embrocationes, Collyria, Fomenta, Linimenta, &c. In some instances these applications are entirely local in their effects, as where a morbid action of the skin is changed by a stimulating lotion, as exemplified in the cure of Psora by the *decoction of Hellebore*, or the relaxed vessels of the tunica conjunctiva of the eye, by an astringent collyrium; in other cases, they operate upon the parts not in contact with the remedy, through the medium of sympathetic communication, as where colic and disorders of the bowels are abated by the application of warm fomentations to the surface of the abdomen, or where paralytic affections are relieved by pumping cold water on the part affected.

Embrocationes. These, as the term* denotes, are compositions of

* Εμβροχη, from βρεκω, *irrigo*.

spirit, decoctions, infusions, or other liquids, applied by *sprinkling* or rubbing them on an affected part.

Linimenta* are understood to differ from embrocations in consistence, the former being of an oily, or mucilaginous density, which increases their efficacy by imparting a certain emollient power, in addition to their other virtues. In popular language, however, liniment and embrocation are generally considered synonymous terms. They constitute a valuable class of remedies, and the observations which Dr. Percival has offered on their utility well merit the attention of the medical practitioner. "Volatile and anti-spasmodic liniments are highly useful remedies, and it is to be lamented that external applications of this kind are not more frequently employed, for there is just reason to apprehend that powerful effects might be expected from them in various diseases." In chronic affections of the viscera, such applications appear highly serviceable, not only from the friction to which they give origin, but from the influence of that species of sympathy which appears to depend upon the mere proximity and continuity of parts and which, as Sir Gilbert Blane has observed, is particularly displayed "in the containing on the contained parts, as that of the integuments on the subjacent viscera."

Collyria†.—Liquid applications to the eyes. The Pharmacopœia Chirurgica contains several different formulæ for lotions of this kind, some of which are simply astringent, while others combine also the virtues of a stimulant.

CATAPLASMATA.‡ *Poultices*, or *Pultices*.

External applications of a pulpy, and somewhat coherent or tenacious consistence.

They are generally extemporaneous preparations, and are calculated to answer several different indications, viz.

1. As Stimulants, e. g. *Cataplasma Sinapis*, L. D. which generally inflames the surface to which it is applied so much as to raise blisters; common salt also, *muriate of soda*, constitutes the active ingredient of a poultice which has lately been brought into considerable repute for the reduction of indolent strumous swellings and enlargements of the glands. §
2. Antiseptics—*Cataplasma Fermenti*, L. (see p. 146.) A powerfully antiseptic cataplasm may be also made by stirring finely powdered charcoal into a common linseed meal poultice. A cataplasm of the boiled carrot, beat into a pulp, has been likewise found very effectual in sweetening foul ulcers.
3. Sedatives. The most efficient of these are composed of *Conium*, *Digitalis*, or *Hyoscyamus*, and are eminently seviceable in can-

* *Illinire, to besmear.*

† κολλυρίον. This term was formerly applied to any medicament, solid or liquid, employed to restrain defluxions; from κωλύω, *inhibo* to stop, and ῥύσις *fluxio*, a running.

‡ κἀλαπλασσω *illino*, to besmear.

§ See *Pharmacopœia Chirurgica.*

cerous and scrofulous sores of a highly irritable and painful nature, to diminish their sensibility and correct the acrid discharges. See *Form.* 18.

4. Refrigerants. In the formation of a cataplasm for this purpose we must avoid the introduction of substances that are slow conductors of caloric; suppose for example our object is to apply the *sub-acetate of lead* in this form, it will in such case be judicious to mix the linseed meal, with oatmeal, or crumb of bread; for if the former substance be used singly, it is liable, from its tenacity, to become hard and dry, and in that state to augment the temperature which it was designed to diminish.

5. Emollients.—(The *modus operandi* of these agents is explained at p. 145.) For which purpose the common farinaceous poultice is the most eligible, made by soaking slices of bread in milk, and simmering them together over a gentle fire until they are reduced to the proper consistence, which ought to be such as to prevent its spreading farther than is designed, and yet not so hard as to occasion any mechanical irritation; the whole is then to be beat smooth with a spoon, and applied as warm as the patient's feelings will readily admit. Some practitioners have doubted the propriety of milk as an ingredient in this composition, and have preferred water as an excipient, not only because the former is very liable to turn sour, but because it does not possess greater powers as an emollient than water; the observations of the editor of the Pharmacopœia Chirurgica upon this question are judicious, and worthy our notice; "the objection," he says, "will certainly hold good whenever stale milk is made use of, or if the same poultice be kept too long applied; but if the milk be fresh, and the poultice renewed night and morning, we do not know any thing that occasionally gives such ease and comfort to the patient as this form of cataplasm. If water be substituted for milk, the poultice is seldom of sufficient tenacity; it is true that this inconvenience may be remedied by the addition of a little linseed meal, but in some instances the meal appears to fret and irritate the skin so much, that patients undergo considerable uneasiness from this cause; an objection to which the cataplasm of bread and milk is seldom subject, especially if it be not applied too hot."

Every substance, whether liquid or solid, may become an ingredient in this species of composition, and although judicious and experienced surgeons have of late very considerably improved the form of their cataplasms, yet the principles of medicinal combination, which it has been the object of the present work to investigate and expound, will suggest many important hints for the farther extension of their utility; and although the direction of them is more frequently left to the nurse than to the medical practitioner, yet in adapting them to each particular occasion some share of chymical address may be necessary; we have already seen that attention must be paid to the selection of ingredients, with respect to their powers of conducting heat, and it is evident that care must be taken not to reduce into pulp, by decoction, substances that contain volatile principles; while in the preparation of active liquids to be subsequently mixed with lin-

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seed meal, it is equally evident that we must be directed by the chymical nature of their composition.

EMPLASTRA. L.E.D. *Plasters.*

These are solid and tenacious compounds, adhesive at the ordinary heat of the human body; they owe their consistence to different causes, viz.

1. *To a due admixture of wax or fatty matter, and resin*, e. g. *Emplast: Ceræ, &c.*

They may be said to differ only in *consistence* from liniments, ointments, and cerates; Deyeux* accordingly proposes to distinguish them by the appellation of *Solid Ointments.*

2. *To the chymical combination of the semi-vitreous oxide of lead with oils or fat*, e. g. *Emplast: Plumbi.*
3. *To the chymical action of the component parts of the plaster on each other*, as *Emplast: Ammoniaci, &c.*

Plasters are generally kept in rolls, wrapped in paper, and when to be used they are melted and spread on leather; in performing this operation the practitioner ought not to apply a heat above that of boiling water; for if metallic oxides be present, the fatty matter will, at a higher temperature, reduce them, in consequence of the powerful affinity of oil for oxygen at an exalted temperature; and if aromatic substances enter as ingredients they will thus suffer in their strength, besides which the fat itself will undergo a very injurious change by a mismanaged application of heat, and the plaster will be less adhesive.

They are employed as remedies to answer two general indications; *mechanically*, to afford support to muscular parts and to prevent the access of air; and *medicinally*, to operate as stimulants, discutients, rubefacients, or anodyne applications. That by affording an artificial support to the various parts of the body, by the application of plasters, we are capable in certain diseases of effecting much benefit, is a truth to be explained upon the principles of physiology, and is daily confirmed by the results of practice; thus by giving support to the muscles of the back, how frequently the stomach is steadied and strengthened? Diseases of the kidneys are in the same way very frequently relieved by tight bandages around the loins; the existence of an intimate connexion between the external and internal parts is strikingly exemplified by the distressing effects which are often experienced in weak habits, such as sickness, giddiness, and other uneasy sensations, from a want of any usual compression, as that of stays, under-waistcoats, &c. The support afforded to persons who have been tapped in Ascites is another instance. I have also lately met with a case in which a morbidly relaxed state of the bowels had harassed the patient for several years, and set at defiance every astringent medicine; upon the application, however, of a tight bandage around the abdomen, the healthy action of the intestines has been completely restored. Sir Gilbert Blane has suggested the trial of mechanical

* Annales de Chimie, vol. xxxiii. p. 52.

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compression of the head in the cure of Hydrocephalus, and several cases, apparently favourable, have been published. Dr. Thackery of Cambridge has related a very interesting history in support of the practice, and judiciously recommends the substitution of straps of adhesive plaster for the bandages of cloth originally proposed by Sir Gilbert. In reasoning upon this treatment, it will be found strictly conformable with the soundest principles of physiology, and with those views in particular, for the illustration of which I have here directed the reader's attention to the subject. Where our object is simple support, we should of course select a plaster which is the most adhesive and the least irritating. Many plasters which have gained great celebrity for their curative virtues will be found to owe all their powers to their adhesiveness, such is the *Emplastrum Oxidi Ferri Rubri* of the Edinburgh Pharmacopœia, for it is impossible that the iron should communicate any tonic effect. The same observation applies to many of those empirical plasters which have at different times acquired so great a share* of popular applause. In the cure of sore legs† the importance of adhesive strapping is generally acknowledged, and on such occasions nothing is superior to the *Emplastrum Resinæ*.

* A respectable Oilman of the name of STERRY, in the Borough, prepares a plaster of this description, which is sought after with great avidity. What a blessing it would be upon the community if every nostrum were equally innocuous!

† Persons who are exposed to fatigue by the standing posture, such as washerwomen, &c., are particularly liable to sores of the legs, which may be prevented and cured by affording this artificial support.

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